This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

SF
551
.H433
1828

B 436992 DUPL

ARTES
SCIENTIA
VERITAS
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
TUEBOR
SIRCUMSPICE
B 436992

20th Congress, 1st Session. [Doc. No. 226.] Ho. of Reps.

SILK-WORMS.

LETTER

FROM

JAMES MEASE,

TRANSMITTING

A TREATISE ON THE REARING OF SILK-WORMS,

BY MR. DE HAZZI, OF MUNICH,

WITH PLATES, &c. &c.

FEBRUARY 2, 1828.

Read, and referred to the Committee on Agriculture.

WASHINGTON:

PRINTED BY GALES & SEATON.

1828.

SF
551
.H433
1828

Carlton Athenaeum
4-16-40

WASHINGTON, *February* 1, 1828.

SIR: I have the honor to present to Congress, through you, a Treatise on the rearing of Silk-Worms, by Count Von Hazzi, of Munich, who sent it to me for this purpose. The Count had seen the resolution of the House of Representatives, directing the compilation of a Manual on the Culture of Silk, and was desirous to promote the patriotic views of the House, by sending the result of his labors on the same subject, and as evidence of the good will he bears to the United States.

I have the honor to be,
Very respectfully,
JAMES MEASE.

The Hon. Mr. STEVENSON,
Speaker of the House of Representatives.

A TREATISE

ON THE CULTURE OF SILK IN GERMANY,

AND ESPECIALLY IN BAVARIA:

OR

COMPLETE INSTRUCTION

For the Plantation and the Management of Mulberry Trees,

AND THE

Rearing of Silk-Worms,

BY THE COUNSELLOR OF STATE DE HAZZI,

MEMBER OF SEVERAL AGRICULTURAL AND ECONOMICAL SOCIETIES,

&c. &c. &c.

TRANSLATED FROM THE GERMAN.

INTRODUCTION.

Four years had scarcely elapsed, since the General Committee of the Agricultural Society of Bavaria had tried new experiments on the rearing of silk-worms, and had published, in the newspapers, accounts of their success, when a strong disposition might be observed in Germany, to recommence, in several districts, the rearing of those insects, and to discover the old mulberry plantations. Similar efforts were made in other countries; and even in those the farthest north.

Notwithstanding the many clear proofs of the success which attended, in Germany, that branch of industry, objections are made to it by a numerous party, who contend, not only that it can never prosper, but that it is altogether impracticable; and the whole scheme, according to their angry declamation, serves merely to deceive the Kingdom, and to expose each individual engaged in the pursuit to the loss of his money, as well as of much valuable time and labor: "the rearing of the silk-worm," they say, "having already been once tried, and abandoned, from a conviction that it was a source of useless expense." It is, therefore, perhaps, high time to view this subject in the light of history and experience, in order to discover truth, and detect error, whereby all doubt may be forever removed.

We shall therefore speak, in the following pages,

I. Of the origin of the rearing of silk-worms, in all countries.

II. Of the errors and blunders, which occasioned the neglect of this branch of industry in Germany, and, particularly, in Bavaria.

III. Of the best ways and means to introduce, to preserve, and to promote it.

Thus, we furnish, as is announced by the titlepage of the present volume, a treatise on the propagation of silk-worms, to all German nations, and especially to the Bavarians, such a treatise having become the more indispensable to them, as an imperfect knowledge of the subject would expose them to old mistakes, and might paralyze the efforts now making to revive this highly important branch of industry. This purpose requires, after a clear exposition of all that has been said in relation to it, in the classical Italian, and French works of Dandolo and Bonafous, a comparative view of the experience

acquired, in remote and more recent times, throughout Germany, and especially in Bavaria—of which latter, I can speak as an eye-witness. Thus, we shall reach the highest point of perfection, which the rearing of silk-worms has already attained in some countries: and from which, Germany can and must, therefore, derive some useful lessons. For, by observing the results of experiments, wherever made, upon the most extensive scale, and in the most approved methods, we shall be enabled to avoid reaching the summit of perfection, painfully and slowly, through a labyrinth of errors, blunders, and half measures.

This treatise will, therefore, furnish all the information necessary to the rearing of silk-worms, on a large or limited scale, in regard to the minutest details of that art, including the particulars of each daily task. Clergymen, schoolmasters, and all other constant observers of the process of rearing silk-worms, and who will, hereafter, teach this branch of economy, and the fair sex, may derive, from this work, new means of improving it; and, lastly, statesmen may draw from it a perfect knowledge of the relations and interests arising from it, in a political point of view.

DE HAZZI.

ON THE

CULTURE OF SILK IN GERMANY,

AND ESPECIALLY IN BAVARIA.

SECTION I.

Of the origin of the art of rearing Silk-Worms in all Countries.

§ 1.

The history of the origin and development or progress of every subject is of great importance, because every thing relating to it can then be shown concentrated, as it were, in a mirror, to be clearly seen, and correctly judged of.

§ 2.

The rearing of the silk worm owes its origin to the white mulberry tree, or to the caterpillar which feeds upon its leaves. This caterpillar is called *bombyx*, from the Greek word Βομβος, "a sound." The Greeks had two sorts of hombyces, and tissues of caterpillars. One of these silky substances, proceeding from a small species of hairy caterpillars, received the name of *koikos*, because it was obtained and manufactured in the island of Cos or Coos, in the Grecian Archipelago, the birth place of Apollo and Hippocrates, now called Stanco. They denominated the other species of caterpillars the Asiatic bombyx, and its web was distinguished by the names of Syrian, Assyrian, or Asiatic, or *silk* proper.

§ 3.

The web of these caterpillars nearly resembles those of other caterpillars and insects; as, for instance, that of the great enemy of the pine forests of Germany, the Phalæna Bombyx pini, and of the other species of Phalænæ, which nature has colonized upon ashes, oaks, palms, black poplars, &c. &c.*

§ 4.

The real silk or silk-web, was first known in ancient Serica, a part of the Chinese Empire (perhaps the northerly part, beyond the 35th degree) and hence the Greeks called it Σηρικη, the Romans *Sericum*, the French *Soie*, the Italians *Seta*, and the English *Silk*. Forests of mulberry trees have been planted there by the hand of nature, and, for many centuries, mankind could have gathered from them the precious thread, and, as from the cotton, provided themselves with clothing, without much labor. But they remained long untouched, in a neglected and unprofitable state.

§ 5.

It was in the reign of the Emperor Hoangti, that a new epoch commenced in the culture of silk. The insects were sheltered, and carefully tended. The real rearing began, and was like the taming and employment of wild beasts for agricultural purposes. The history of China mentions, that, 700 years before Abraham, 2,700 years before the Christian era, the Emperor Houng-Ti, "the Emperor of the

* The silky substance produced by these insects is not entirely neglected in Asia. According to Du Halde there is an insect in the Chinese province of Shan Tung, which spins its silk in long threads on trees and shrubs, from which a stuff resembling linen, of a coarse but strong texture, and of a reddish color, is manufactured, and called Kien-tchon. It is now more than thirty years since experiments of this kind have been tried in Germany on such webs. We refer the reader to the "*Complete History of the advantages that might be derived from many plants hitherto neglected*:" by the late Professor Herzer: Regensburgh, 1794. This gentleman converted these webs into hats. About four years since, Lieutenant Sanson, of Munich, again called public attention to the tissues found on the German or black poplars, (populus nigra.) The General Committee of the Agricultural Society caused them to be collected in many English Parks, and tried the experiment, which, however, failed of success. These webs could not be even used in the fabrication of coarse paper, and thus about two hundred weight of it is still lying profitless. The failure of this experiment may be attributed chiefly to the method of fabrication, to the imperfection of the cards, &c. The essays made by Lieutenant Hebenstriet, of Munich, with the wads of the lote-trees and caterpillars, a species of moths found upon the spindle trees, upon vines and cherry trees, were still more important. He taught these insects to weave good wads for ladies' veils; (last year,) for an air balloon; and, still later, a dress woven in a nut shell, for the queen; in the following manner: He fastened some smooth shelves of lote wood, and (in default of this timber) of willow wood, in the form of a bridge, as high as possible, upon two or more lote trees, swarming with caterpillars, having first covered the shelves with bruised lote leaves, and moistened them frequently with a solution of lote salt; and upon these the caterpillars wove their webs. We refer the reader to a paper furnished by the Director Von Shrank, respecting this experiment, for the *Transactions of the Munich Academy of Science:* vol. vi. p. 69.

Earth," who reigned for more than a hundred years, taught the Chinese to construct houses, carts, ships, mills, and other useful things of a similar kind, and persuaded, moreover, his first and legitimate consort, Si-ling-chi, to attend to the silk-worms, and to try several experiments, in order to increase their utility; wishing, as he said, that his wife, the Empress, might also contribute to the welfare of his subjects. The Empress accordingly gathered the silk-worms from the trees, and, with the women attached to her household, endeavored to tend them with much care, in the Imperial apartments, to supply them abundantly with mulberry leaves, and to keep them very clean. It was soon discovered that they thrived more in rooms than in the open air, where they were constantly exposed to their natural enemies, serpents and spiders, and to the ill-effects of changes of temperature; all which were obviated by subjecting them to domestic care. The cocoons gathered in the open air, and in the rooms, were also very different; the latter being not only more numerous, but of a better quality, and richer in silk. Care was afterwards taken that the eggs were hatched within the rooms; and there were thus two kinds of silk culture; the natural and the artificial; the superiority of the latter becoming gradually more and more manifest.

§ 6.

Similar exertions for the domestic culture, were made by the succeeding Empresses, among whom the consort of the Augustus of China, Yao, principally distinguished herself. That art became thus the principal occupation of the Empresses, and several apartments of the Imperial palace were given up to it. From the highest rank of females, it came to be exercised by the whole fair sex, and obtained progressively such favor, that it turned to be the principal source of the wealth of China, which was from thence denominated, "the inexhaustible storehouse of silk." The fair sovereigns of the Empire did not, however, content themselves with the rearing of the worms, but attended, also, to the carding and weaving. The original promotress of that art in China, the Empress Si-ling-chi, had already taught her women to convert the raw material into clothing stuffs, and to embroider them with representations of flowers and animals.

§ 7.

Soon, from the Emperor, down to the learned classes, the Princes, Courtiers, and Mandarins; and in short, all who were in sufficiently affluent circumstances, were dressed in satin or damask. This greatly encouraged the rearing of worms, and the weaving and manufacturing of silk, especially as it occasioned a sumptuary regulation, which still continues to subsist, and marks the distinction of ranks among the Chinese: the higher classes having appropriated to themselves the exclusive privilege of wearing the silk stuffs, and assigned to the inferior orders, cotton and cloth dresses.

§ 8.

Subsequently, silk became an article of exportation. From China, it went into all the other countries of Asia, and afterwards to Europe. The traders of Serica journeyed, at first, with the silken stuffs over the whole breadth of Asia. Two hundred and forty-three days were usually spent by the caravans, in going from the coasts of China to those of Syria. The prices they obtained, far exceeded the expenses incurred; and thus the silken stuffs were found in every mart; but principally in Nisibis, in Mesopotamia, and among the most active traders in the world, at that epoch, the Phœnicians, who, at length, carried them to the east of Europe.

§ 9.

The Greeks derived their first knowledge of silk from the military expeditions of Alexander into Persia and India; and Aristotle called to it the attention of his countrymen, as early as three hundred and fifty years before Christ. We have already related by what means the Romans obtained the silks. At first, on account of the high price of the silk, these stuffs had but the chains of silk, and the filling either of linen or cotton; or *vice versa*, and may therefore be called half-silk stuffs. Roman writers gave them distinct names. But a general outcry soon arose, even against the half-silk stuffs, under the pretence that they were too expensive and too womanish. Under the Emperor Tiberius, seventeen years after Christ, Haterius and Fronto declared themselves strongly upon this subject; and it was ordered "that no silk dress should henceforth degrade a Roman citizen." Even under Marcus Aurelius, in the year 173, such attire was only worn by ladies of the highest rank. The Syrian voluptuary, Heliogabalus, was the first who wore a dress wholly composed of silk, in the year 218; but in 270, A. D., Aurelianus denied to his wife, Severa, such a dress colored with purple. "Let us not," said he, "exchange gold for spiders' web:" and, indeed, at that epoch, silk was of the same value with gold, weight for weight.

§ 10.

The silk trade increased, nevertheless, more and more in India, Persia, and Arabia; principally from the progress of luxury in Eastern Europe, and the consequently greater demand for silk fabrics. No law could counteract such a propensity; and it was accordingly disregarded entirely in the eastern empire, under the reign of Justinian I, from 527 to 565. Through the intercession of the ill-advised Empress Theodora, the wife of that Emperor, a monopoly of the silk trade was granted to a broker of the name of Peter Bersames, who became afterwards chief of the imperial body guard. At this time, not only silk stuffs, but raw silk were imported from China, through Persia, and chiefly by way of Samarcanda and Bokhara, into the

Phœnician cities of Tyre and Berytus, where silk was manufactured, and from whence it was afterwards conveyed into foreign countries. The monopoly granted to Bersames tended, however, to diminish greatly in those cities the profits of the silk manufacturers and traders. The greater number of the former emigrated into Persia, and opened there workshops.

§ 11.

In the meantime, the demand for silks had prodigiously increased, along with the wealth and luxury of the Grecian court, of the inhabitants of the capital, and other principal cities; and the Persians enriched themselves by carrying on that trade. This awakened the jealousy of the Emperor Justinian in regard to that branch of industry and commerce; and he determined to procure the same advantages to his own empire. His first step with this purpose, was to send an express embassy to the Kings of Ethiopia and Abyssinia, to invite them to appropriate to themselves the silk trade, considering that they could obtain the silk direct from India, and had it in their power to send it to Alexandria through the Nile. The ambassadors explained the great advantages that would accrue from it; observing, by way of argument, that Christian sovereigns ought not to permit the heathen enemies of the Emperor to enrich themselves at the expense of his subjects. These suggestions had, however, not the least success, and the autocratic sovereign of the great Roman Empire in the East, failed to procure to his subjects the silk trade.

§ 12.

A mere chance produced what no exertion had been able to effect, and it gave a new face to every thing connected with that industry, and occasioned the production, fabrication, and trade of silk in Europe. Two Monks presented themselves at the Court of Constantinople, and offered to reveal the secrets of the rearing of silk-worms, which they had learned during their missionary expedition in China. The Emperor, in his joyful surprise, made them rich presents: but it seems that the friars possessed only some seed of the mulberry tree, and considered themselves thereby completely provided, because they thought, that, when the trees should grow, the worm could not fail to accompany them, as in China. But this was a hasty conclusion; and the monks being encouraged, by the many splendid promises of the Emperor, returned to China, in search of silk-worms' eggs, though the exportation of them from that Empire was punished with death. They got back to Constantinople in safety, towards the beginning of the year 555, and brought the precious eggs with them, concealed in their hollow pilgrims' staves. Nothing was now wanting to the success of the new industry. According to Byzantine authors, the eggs were hatched by heat of manure, as soon as the mulberry trees began to bear leaves, which

served to feed the worms. In Greece, too, noble ladies were the first to attend to the rearing of the worms, with the assistance of their servants, and their children, and encouraged and extended the culture and the fabrication of silk throughout the whole country. Under Justin II, the successor of Justinian I, ambassadors from Sogdiana declared, that the Grecian silk was, in no respect, inferior to that of China, and highly complimented the Emperor upon his success. Silk was, at length, produced in such abundance, that the Emperor Alexius, as it is related by his daughter Anna,* the historian, distributed in the year 1005, on the eve of a battle with the Scythians, among those of his soldiers whom he was unable to provide with armour, helmets and breastplates of iron-colored silk.

§ 13.

At a later period, Spain and Portugal received from their Arabian conquerors, the art of fabricating silk. It was in 711, under the Caliphs, that the Saracens conquered Spain; and they soon taught the inhabitants of that country to improve their agriculture, their manufactures, and their arts. "With the same vigor," observes Professor Dresch, in his *Universal History*, "with the same earnest zeal, with which they fought, for more than a century, they pursued the cultivation of science, under the auspices of the great Caliph Haroun Al Raschid, the contemporary of Charles, and his son Al Mamun. These sovereigns regarded it as a maxim of policy, that the welfare of a nation consisted in its civilization. The Koran had classed agriculture, industry, and commerce, among the good deeds of the believer. Like the Roman Senators, who took their sirnames from the plants which they had principally cultivated, (as for instance, the Fabii and Lentuli,) the Arabian chieftains were fain to adopt, in the quiet of their private lives, names alluding to their skill in some manual industry; though, at that time, Central and Western Europe knew of no other pleasure than that derived from war, from wine, and from the chase. Charlemagne was the only sovereign who made any provision for the cultivation of the mind: but the benefits he conferred, terminated with his life; and, from that time, the Arabian Empire was the only seat of science, industry, and civilization. We owe them much in regard to agriculture; we are indebted to them for the manufacture of paper; for the expression of quantities by figures, and for many improvements in the art of dying: nay, our language bears numberless traces of the inventions transmitted to us by the Arabians. The historian and Bishop Otto de Freysingen, speaking of the great progress which silk manufactures had made in Spain, relates that, after the siege of Milan, Frederick I, held a diet of the Empire, in 1158, in the fields of Roncaglia, at which were present, in magnificient attires, the Ambassadors of the Genoese, who recently had conquered from the Saracens two important cities,

* Anna Comnena. See Gibbon, in regard to the merit of her History.—*The Translator.*

Lisbon and Almeria, both famous on account of their manufactures of silk, and had made a rich booty. The later wars, and the defeat of the Saracens, might have been the cause, that this species of industry did not pass the limits of the Spanish Peninsula, and fell partly into decay: for it cannot be doubted that the rest of Europe received it from Greece."

§ 14.

Greece remained a long time in the exclusive possession of the silk culture; and it seems that the Saracens were never acquainted with the breeding of the worms, and were only skilled in the art of manufacturing beautiful stuffs from the raw silk, which they received from the great emporium of Bagdad. The war of 1146, introduced that culture into Italy. According to historical authority, Roger I, the Norman King of Sicily and Naples, hearing that the great Emperor Manuel Comnenus was negotiating an alliance against him, with Conrad III, of Germany, resolved to send an embassy to Constantinople, in the hope of obviating the danger which threatened his power, and to propose a matrimonial alliance with one of the daughters of the Emperor; but Manuel threw the ambassadors into prison, and Roger, having accordingly collected his land and maritime forces, was so fortunate as to conquer successively Corfu, Cephalonia, Negropont, Corinth, Thebes, Athens, and several other cities and islands of Greece; from whence he carried with him into Sicily, an immense booty, and several thousand captives. Among the latter, were a great number of persons acquainted with the culture and fabrication of silk. Roger gave orders to treat them with much kindness, and persuaded them to settle in Palermo, offering them the most advantageous conditions. They introduced there their useful industry, and opened manufactures which soon acquired great celebrity; and from thence, it was transmitted to the Calabrians, and at length propagated through the rest of the Kingdom of Naples.

§ 15.

Sicily and Naples kept it mysteriously for a long time; and not earlier than in the sixteenth century, the mulberry tree and the breeding of the silk-worms, were introduced into the rest of Italy; and at first in Upper Italy. Emanuel Philibert, Duke of Savoy and Piedmont, contributed the most to it; and those countries are also indebted to him for the introduction of the olive tree. From thence that new source of national wealth was transplanted into the Milanese, and the greatest part of Italy; and very soon that country became the principal seat of silk fabrication.

§ 16.

Its propagation through the other countries of Europe, was quite as slow. At first their inhabitants seemed to be satisfied with admir-

ing and valuing the silk stuffs very highly. It was only in the year 1180, under the reign of Henry II, that such stuffs, imported from China, began to astonish the English. At a later period, the Greeks supplied France and Germany with these products; which countries, in the middle ages, received them from the manufactories of Italy. Charlemagne wore above his linen doublet and under-garment, a silk scarf round his waist. Not sooner than in the middle ages did the sumptuous silk cloaks, embroidered with gold and silver, worn by the knights over their more more martial equipment, come into fashion. History mentions, as examples of extraordinary splendor, that Henry III assembled, at the marriage of his daughter with the King of Scotland, a thousand knights attired in silk. Charles VI, of France, in order to display his magnificence, wore, from the year 1422, constantly, a black velvet coat-of-arms, even in the hottest days. His successor, Charles VII, wore, at his entrance into Rouen, in 1449, a beaver lined with velvet, which was the most costly and elegant head ornament known at that time. In 1485, orders were issued in Germany against such expensive apparel; and females were expressly directed not to wear more than four costly dresses at the tournaments; and a whole suit of silk and gold was altogether prohibited to them. Even Charles V, took off his little velvet hat, at an inspection of his army, in 1547, to prevent it from being spoiled by the rain.

§ 17.

The silk stuffs still continued to be imported from the east and from Italy: but the first knitted silk stockings, which Henry II wore, and which attracted extraordinary notice, came from Spain; and Henry VIII, as well as Edward VI, were likewise supplied from that country with the same article, for their personal use. No silk manufactures existed as yet in France or Germany; and not earlier than 1455, did females begin to spin and sew with silk in England; and in 1482, narrow stuffs and ribbands began to be manufactured from raw silk, imported from Italy. In 1521, silk weavers emigrated from Milan into France, where, likewise, some attempts were made to weave Italian silk; but all these were but partial experiments.

§ 18.

It was reserved to the great Henry IV, to introduce the culture of silk into France, at the beginning of the seventeenth century; and it constituted one of the splendid epochs in the history of that kingdom. Olivier de Serres was the most instrumental in this new acquisition, and the French call him, to this day, the patriarch of agriculture. In the year 1600, he published a book, entitled "*Théatre d'Agriculture et Mesnage des Champs,*" by which light, as it were, succeeded darkness in rural economy; and it was read with so much eagerness, that thirteen editions were printed within a short space of time. This success, however, he chiefly ascribed to the excellent King, and to his

wise Minister Sully, who were the first to view agriculture in all its important relations, and gave to France the blessings of a golden age.* In sending to the King a copy of his work, Olivier wrote to him:

"In presenting to your Majesty *the Theatre of Agriculture and Management of Fields*, I do but call your attention to your own affairs." Delighted with the book, the King honored the author with a most obliging letter, written with his own hand, and desiring him to come to Paris. Olivier left, with great regret, his fine estate, in 1601; though he could not disregard a call which tended to make him more active for the good of his country. Scarcely arrived at Paris, he received the greatest distinctions: he soon became the confident and adviser of the King, and of Sully; and wise laws and regulations, concerning agriculture, were enacted. The King offered Olivier the highest honors—but he asked one favor only: that all useless trees might be banished from the Royal gardens. When this was granted, Olivier went to work with such diligence, that, throughout the Kingdom, the measure was executed within a short time. But this was not enough for his patriotic zeal: upon his recommendation, 14,000 mulberry trees, and a great quantity of seed of the same tree, were ordered from Italy, to supply the vacancies intentionally made in the Royal gardens. In later times, he procured, also, from Italy, silk-worms' eggs, and persons acquainted with their rearing. The trees, the eggs, and a printed instruction, respecting their use, were distributed, *gratis*, to agriculturists; and the new industry was particularly recommended to the fair sex. Well, therefore, may Henry and Olivier be called the creators of the culture of silk in France.

§ 19.

The most singular feature of this innovation is, that the King did contribute more to its introduction, than any of his Ministers. Him alone, was Olivier able to convince of its utility. He failed with Sully, who generally acted with great wisdom; but who, upon this occasion, was directly opposed to salutary advice. It is curious to find the following remark, at the conclusion of the 16th book of Sully's Memoirs †: "I shall not omit to mention here, what was done in "France, in the year 1603, in regard to manufactures, and especially "those of silk. Henry, who embraced, with ardor, every means to "increase the welfare and glory of the Kingdom, suffered himself to "be persuaded, that nothing would be easier than, not only to become

* From such impulses, the good King used to say, *that each peasant ought to have, daily, a chicken in his pot:* and hence the eager search after talented men and the favor shown to them; the facility with which Sully extinguished, in the space of ten years, the public debt of two hundred millions, that had been accumulated during the war; the surplus of thirty millions, which the Treasury possessed, ten years later; the general welfare throughout France; and, finally, the encomiums bestowed, to this day, upon the great Monarch and his truly great Minister.

† Mémoires de Max. de Béthune, Duc de Sully, Londres, 1767, Vol. V. p. 74. This is altogether an interesting work, especially for German statesmen.

"independent of foreign countries, in regard to the fabrication of such "silk stuffs as are imported into France, and which the French were "accustomed to procure from a distance, but to make them serve as "an important branch of the national trade. Nothing more was "necessary for this, it was said, than to promote the rearing of silk-"worms, the plantation of mulberry trees, and the building of hous-"es appropriate for this species of manufacture. I was opposed to "this project, which could never please me; but the King had already "taken a fancy to it, and all that I said and could say, was in vain." His objections, which he candidly states, related, however, not exclusively to silk manufactures, but were intended to check the growing luxury. "I dwelt," says he, with his characteristic candor, "upon "this subject as much as I could, to impress the more the King "with my opinion; but I was unable to convince him. 'Are these "all the good reasons that you can bring forward?' Henry said. "'I would rather beat the King of Spain, in three regular battles, "than be obliged to fight against all the gentlemen of the gown, "all the scribblers, and fine gentlemen, with their wives and "daughters, which you will raise against me, by your admirable re-"gulations.' Your Majesty is determined upon it, (quoth I) and "I will say no more about the matter; but time and experience will "convince you, that France is not made for trappings and finery."

§ 20.

How much would Sully now be astonished, could he behold the evidence of his mistake, and of the foresight of his Royal Master! Instead of continuing to pay to foreign merchants four millions of francs, annually, for silk, the French draw many millions from their ancient suppliers, and enrich themselves in proportion.

In subsequent times, and especially during the reign of Louis XIV, silk manufactures became so numerous, through the fostering protection of Colbert, that they have been, down to the present time, the most productive source of the wealth of France. The annual profits from this single branch of industry, in France, are estimated at forty millions of florins; of which, a tenth is derived from the production of the raw material, and the remainder from the manufacture. According to the most recent statistical data, that Kingdom derives, from the production of silk, in the twelve departments where it is attended to, 23,560,000 francs per annum, and 84,000,000 francs from the fabrication: and, consequently, the capital which is brought into circulation, in both ways, amounts to 107,560,000 francs.

§ 21.

England beheld, with no small degree of jealousy, the prodigious plantations of mulberry trees in France, the increasing production of silk, and the consequent multiplication of silk manufactures. James I accordingly endeavored to introduce this industry into his own King-

dom; and, in 1608, a most earnest appeal was made to the British public, in regard to the advantages that might be derived from the plantation of mulberry trees; but nothing was done: and only as late as 1820, was this subject seriously taken up; some inconsiderable experiments having sufficiently established the fact, that these trees, and the precious insects which feed upon them, thrive as well in England as in France. But, long before that epoch, silk manufactures had flourished, to a considerable extent, in England—the raw silk being imported from Italy. There existed already, in 1629, so many of these establishments in London, that the weavers of the city and of the environs were divided in corporations; and, in 1661, the individuals which composed them, were more than 40,000 in number. The revocation of the edict of Nantz, in 1685, contributed greatly to the future progress of this industry—the most skilful French weavers having taken refuge in England. Next to this cause of the rapid progress of this manufacture, must be mentioned the silk machine erected at Derby, in 1719. The reputation of the English fabrics increased, at length, to such a degree, that, even in Italy, as it is stated in Keysler's Travels, (vol. 1, p. 279) English silk commanded a higher price than the Italian.

§ 22.

The history of the cultivation of silk, in Germany, divides itself naturally into three epochs; of which the two former may be called the unlucky. According to written documents, the first experiment on rearing the silk-worm was made in 1598, at Rothenburg, on the Tauber, by Dr. Liebauf, and was continued for some length of time. It was repeated at Wurtzburg, Hochheim, Dresden, and Stutgard; but the results corresponded nowhere to the expectations to which it had given rise. Their proximity to Italy could not, however, fail to inspire the Bavarians with a desire of pursuing the same industry. They made, at first, some trifling attempt in that way, and, in 1669, a more serious one; a numerous company having been organized in that year, by individuals belonging to the most distinguished families of Munich, who made up a fund of several thousand florins. They entered into a contract with an Italian, by name of Lucas Uffele, who engaged himself to supply them, for the space of ten years, with mulberry trees and silk worms' eggs from his own country, and to erect a laboratory upon the green, (at Munich,) in order that the breeding of the insects, as well as the fabrication of silk, might be carried on, at once, upon a great scale, and extended throughout the country. But the most immediate result was a long train of judicial proceedings against the Italian, who was thrown into prison, and only obtained his release, and a declaration of his innocence, after a confinement of six years and a half. We shall extract a remarkable passage from the decree issued, upon this occasion, by the highest judicial authority, on the 14th of February, 1676: "Both parties (it is said) have reciprocally produced the heaviest charges of dishonesty and deceit:

but the real cause of the ill-success which has attended the enterprise, must be sought in the circumstance, that the company had spent so much money in unnecessary and too expensive buildings, that there remained but a few thousand florins for the accomplishment of the scheme: and finding themselves consequently unable to meet their engagements, the Italian merchants were compelled to sue them before the judicial authorities." After having experienced heavy losses, the company declared itself dissolved: and thus this great project resulted in a complete failure. After that time, no one seemed to have the courage to do any thing in that line.

§ 23.

A better spirit did not begin to awake in Germany until the middle of the last century: and we thus arrive at the second epoch in the history of the subject we treat of.

Frederick the Great, having chanced to see a silk manufactory at Torgau, during his military operations in Saxony, and having had his attention called to the descendants of some French manufacturers, who had emigrated from their country in consequence of the revocation of the edict of Nantz, and who had established themselves at Berlin, gave the first impulse to the regeneration of the silk culture in Germany. He ordered plantations of mulberry trees to be multiplied, extensive buildings to be erected, printed instructions on the management of the trees and the rearing of the silk-worm to be distributed gratis; and he promised considerable bounties to those who would devote themselves to that industry. According to a detailed account,* the quantity of silk collected in the provinces of Magdeburgh, Halberstadt, Brandenburgh, and Pomerania, amounted to 6,849 pounds. From 1744 to 1755, 35,678 mulberry trees were planted in Saxony, which, in 1753, produced 150 pounds of silk. Similar success attended the endeavors which were made in the county of Hanau, in Wurtemberg, Anspach, and Baireuth, and on the estates of Prince Lichtenstein, in Austria. But the most active promoter was the Elector Charles Theodore in the Palatinate, where, under his auspices, 80,000 mulberry trees were planted; and his example was soon followed in the duchy of Deux-Ponts, and in that neighborhood. Encouraged, at first, by the bounties offered, and afterwards being expressly commanded, the peasants devoted themselves to the new industry, and much was done to ensure its ultimate success. Charles Theodore brought, in 1777, into Bavaria, the same favorable disposition which he had evinced in the Palatinate. A special silk Superintendency was erected by an ordinance, which bears date of the 20th of December, 1781, and whose residence was fixed in the capital of the Electorate. By another edict of the 26th January, 1783, that Department received further organization, in consequence of which it bore afterwards the name of General-Silk-Superintendency, with

* V. Threber's Collecta, a German periodical, 1755.

an assignation of 6,000 florins upon the Treasury; which was, however, considerably increased in later times. A company was also incorporated, by which extensive plantations of mulberry trees were soon made at Munich, Landshut, Engelkofen, and Arnsdorf, at some later time at Straubing and Burkhausen, and the promenades, ramparts, and streets of many cities were ornamented with these trees; buildings were erected, officers appointed, silk manufactures multiplied, and much money expended in that way. But, to the great satisfaction of foreign traders, this second epoch, which had commenced under the most favourable auspices, ended soon, as unfortunately as the former, though the national industry had been encouraged by high duties upon foreign imports. An edict, dated June 20, 1787, considerably abridged the power of the General-Superintendency, which was at length entirely abolished. The company was dissolved, after a loss of several thousand florins; the mulberry-gardens were neglected, and, in process of time, the trees which ornamented the streets, terraces, and promenades, were cut down; and the inhabitants of Germany seemed to rival each other in characterising in this manner the termination of the second epoch in the history of the silk culture among them.

§ 24.

"It might have been expected," says the abovementioned writer, "that so extensive a plantation of mulberry trees, the number of which amounted to one million, would have enabled Germany to leave off the importation of silk from any foreign country. But whilst the fabrication of it made rapid progess in France and Italy, every establishment of the same kind declined in Germany. At length, the wars arising from the French Revolution completed that unfortunate state of things: no mulberry tree was left upon the German soil; and the culture of silk was so much neglected among its inhabitants, that hardly any sign of it remained."

§ 25.

This is the more to be regretted as the use of silk, instead of diminishing, has greatly augmented, and to such a degree, that, from the most fashionable ladies, down to the lowest female servant, each wears some silk article: and the interior of houses, churches, and palaces, shines with silk drapery. How much Germany pays for this single commodity to foreign countries, may be estimated from the following statement of the sums expended by Bavaria alone:

GENERAL STATEMENT of the quantities of silk imported into Bavaria, presented by the King's Minister to the States General of the Kingdom, during their late session.

Years.	Qualities of silk.	Quantities.	Value.	
			In part.	In toto.
		Cwt.	*Florins.*	*Florins.*
1820, '21	Raw silk	9	100	900
	Carded silk	30	150	4,500
	Spun silk	409	250	101,250
	Silk stuff	1,850	2,080	3,700,000
				3,806,650

It must be observed that this importation of one single year, can only be considered as a minimum; as, on the one hand, the smuggling trade, which is considerable, is not brought into account; and, on the other hand, the official valuations are rather low: for the ordinary prices are (taking them at their most moderate rate) as follows:

Raw silk,	1	pound	1 florin
Carded silk	1		10
Spun silk	1		14
Silk stuff	1		34

Whence it appears that the quantities mentioned in the *General Statement* have really cost

Florins.
900
30,000
571,000
6,290,000
6,891,900

Bavaria pays thus, taking but the minimum of imports, from six to seven millions of florins, annually, to foreigners, as a tribute for the use of silk. But it really amounts to eight or nine millions: and from these data, each German State may calculate the amount of its own losses from the same cause.

§ 26.

An accident brought about the third and most recent epoch, which began with the year 1821. During the distribution of premiums, at the agricultural solemnities of that year, in the circle of the Lower

Danube, high praise was given to the exertions which had been made for the revival of the silk culture, by a noble lady, by name of Leeb Straubing. My own attention was thereby strangely kindled, and I remember that on my entrance into public life, as Aulic Counsellor, I heard much in the Council of silk culture, and that we had a good deal of trouble with the silk buildings and silk manufacture; whilst, at that time, there was hardly a mulberry tree in the whole neighborhood of Munich. Upon this, I requested Mr. de Nagel, Secretary of the General Committee of the Agricultural Society, and who had become acquainted with the culture of silk in Hungary, to draw up a memorandum respecting the mulberry tree; and I stimulated him by the following remarks, which I caused to be inserted in the Weekly paper of our Society: "More information is desired, especially as to the question from what circumstances the plantations of mulberry trees, and the silk manufactures, which were established in Munich, Landshut, &c. under the Elector Charles Theodore, at so much expense, have fallen into decay; and by what means the difficulties arising from the climate could be removed: and finally whether no private plantation or establishment of the kind still remains in Bavaria? This important subject ought to be considered, under all its aspects; and much useful intelligence may be expected from such a discussion."

These suggestions did not remain without effect, especially as I took care that a diligent search should be made among the oldest documents deposited in our archives; and I directed Mr. de Nagel to enter into correspondence with the abovementioned lady, and to converse upon the subject with the officers of the late Superintendency. Much information was thereby obtained. With fifty silkworms' eggs, furnished by Lady Leeb, the first experiment was make in the Spring of 1822, under the direction of the General Committee of the Agricultural Society. Fortunately three mulberry trees were discovered not far from the capital. Within 44 days we were in possession of 50 beautiful cocoons, and the butterflies, into which they were metamorphosed, produced 2,500 eggs. These were hatched in the Spring of 1823, at which period more mulberry trees had been discovered. In 1823, the number of silk-worms' eggs, of which we could dispose, amounted to 600,000, which were offered to be distributed to all persons who should be willing to devote themselves to the culture of silk, and who should discover some mulberry trees near their residences. This measure was crowned with the desired success. Demands for eggs, and directions for their use, reached us from several parts of the Kingdom, and in the process of time a still greater number of mulberry trees was discovered. We were informed, at the same time, how madly whole alleys of the precious trees had been cut down, even very recently, to serve for fuel like the commonest wood.

§ 27.

When it was known, in 1823, that a merchant by name of Spohrer, and the silk manufacturer, Mr. Wurtz, were engaged in the silk cul-

ture, the committee requested Captain Grouner* and Lieutenant Sanson to inspect those establishments; and the information thus obtained, confirmed the fact, that these private enterprises were very expensive; whilst, on the contrary, the experiments made by the committee had not cost any money. They fixed, however, the attention of the King; and when Mr. Spohrer presented to His Majesty a suit made of his silk, gold medals were presented to him, as well as to Mr. Wurtz. It became now a matter of serious deliberation, how mulberry trees could be procured for those who manifested an intention of attending to the business. At length, Captain Grouner and Lieutenant Sanson proposed to form a general fund, by means of private contributions. The sum obtained in this manner amounted to 880 florins 48 kr.

§ 28.

Such is the origin of the Board of Silk Culture, which was created on the 14th of March, 1824. An extract from the Journal of the Board will sufficiently elucidate its object and fundamental principles.

"*New Board for the extension of the culture of Silk, near the General Committee of the Agricultural Society of Bavaria.*†

"To-day, March 14th, 1824, assembled the elected members for the new Board, which, in conformity to the resolutions adopted by the General Committee of the Agricultural Society, on the 11th of February, is to be organized in the same way as the Board for Agriculture and for the improvement of the country. After the reading of the resolutions and the list of the members of the new Board, the Counsellor of State, Mr. de Hazzi, spoke in the following terms:

"*Gentlemen:* The resolutions which have just been read, explain the end for which you are convened. It is not less than to procure to your country an important branch of production and industry, known by the name of culture of silk." "That industry has already once existed: your exertions will be vain: it could not prosper in past times; our climate is contrary to such an enterprise." "Such are the objections I am prepared to hear from our adversaries; but we must take care not to be misled by such arguments; for this, like every other useful undertaking, must fight its way before it can obtain an adoption. Silk culture has had the same fate in all countries."

(I introduced here an abridgment of the historical account contained in the present work, and after this I went on saying:)

"What is, after all, our purpose? To profit by the experience of the world, and to avoid the errors that have been committed at other

* This worthy gentleman, who had rendered distinguished services to agriculture, and was one of the founders of the Agricultural Society, died shortly after the event mentioned in the text.

† The reader is referred to the Weekly paper of the Agricultural Society for the fourteenth year of their proceedings, p. 423, 424.

times. Like the Greeks, Italians, and French, we wish to call into existence the culture of silk. Let, therefore, our motto be: *no Board connected with the Government, no particular Administration, no public officers, no expenses: the culture of silk shall be an affair wholly belonging to the people: an incidental business, the secondary work of servants, children, paupers, and old people.* Encouraged by the example of Greece, Italy, and France, we wish to trust it to the fair hands of ladies, who could, by way of amusement, and without any expense, obtain, within six weeks, a most elegant material for the ornament of their persons and of their apartments.

"The whole enterprise requires nothing further than to feed the silk-worms in the Spring with mulberry leaves; a care not greater, but surely more useful, than the feeding of dogs, birds, and cats; to keep them clean, and to grant them a little space in a room to spin their silk. These are the means by which the cocoons are obtained, and these furnish again eggs: and here ends the whole culture. for the cocoons themselves are articles of commerce.

"What will, then, be the business of the Board? It is very simple, and is reduced, for the present—I. to attend to the plantation of mulberry trees; II. to procure silk-worms; III. and lastly, to guide in the use of these means. Only after these three preliminaries have been attended to, begins the last chapter of fabrication. For, the first step must be to produce the substance fit to be sold, before the fabrication can be thought of; and even for this latter object, some preparatory measures have already been taken.

"We shall now say a few words upon each of these three heads, under which we have ranged the whole subject.

"I. The plantation of mulberry trees must, in the first place, receive our attention. We owe to the liberality of the King, and to some voluntary contributions, the means we already possess of beginning such a plantation. We expect, to-day, the trees, cuttings, and seed. But we must take care to avoid the errors and blunders of yore, and not ascribe it to the climate, if the trees should not thrive. The climate has nothing to do with it: for the mulberry tree has resisted the temperature of Russia and Sweden; and we find them to this day in Germany, wherever they had been planted with any sagacity.

"We are at last convinced of a fact which had been too much overlooked; namely, that the worms do not come out from the eggs before the mulberry leaves have begun to shoot. They would otherwise die, as soon as they begin to live. The principal blunder in the old plantations was, that no appropriate selection was made; whereas the *white* mulberry tree serves alone for the rearing of silk-worms. Not all white mulberry trees are, moreover, equally good. They must not be planted separate along the street, exposed to the dust or to northerly winds, nor in a marshy soil; but, on the contrary, in sheltered places, and with an exposure to the sun. Care must also be taken that the trees shall not remain entirely leafless,* because leaves hold the same

* Bonafous is not of this opinion. See hereafter, § 56.

relation to plants and trees, as the lungs to the bodies of men and animals. A leafless tree dies soon: not more than half of its leaves, or to the uttermost, two-thirds of them, should be stripped. Finally, hedges procured from the seed, may supply the place of standard trees: for they are, after three years, as abundantly covered with leaves.

"II. Much depends, also, on the choice of the worms; and the quality of the silk follows pretty closely that of the insects; at present we may content ourselves with those we have; but in future we must endeavor to procure the finest species from Italy and Spain. More instruction will be found, on this topic, in the brief treatise drawn up by the General Committee of the Agricultural Society, and which may be had gratis. Silk-worms' eggs will, meanwhile, be distributed also gratis, in proportion to the number of old mulberry trees that may be discovered.

"III. In regard to the feeding of the worms, the cleanliness they require, and other details of their procreation and preservation, we refer to the abovementioned treatise. I will only mention here, that dry leaves, free from dust, are to be daily distributed. The leaves that fall from the tree belong to him who gathers them; and the trees should, therefore, be planted in open places, such as church and school yards; and the Board is aware that the most economical part of the business will long need their protection and advice.

"But if once the three following preliminary conditions are obtained, namely—1st. that mulberry trees be planted for the use of every body; 2d. that the best species of silk-worms be distributed, without any remuneration, to all persons who wish to have some; and, 3d. that the public becomes convinced, that, without the smallest expense to the State, any individual who desires, may draw from naught a considerable gain—who will blame us, then, if we hope to see, within a few years, the culture of silk extended throughout Bavaria, and this country enjoying the same advantages which were ensured to France by Olivier, who is deservedly ranked among the great men and benefactors of that kingdom? We can trust the more to these expectations, as they are warranted by some practical and successful experiments, made in Bavaria, some years since. Let us begin, therefore, our task with much confidence: let us promote this important branch of agriculture and industry, by all the means we possess; and let us remove the difficulties which still embarrass its revival. When we shall have done so, our country will be indebted to us for an important improvement, and we shall have obtained the reward most worthy of our exertions."

After I had finished my observations, the society proceeded to the election of the members of which the new Board was to be composed.

I was elected President, Mr. Counsellor Wepfer was appointed Secretary, and Lieutenant Sanson, Deputy Secretary.

The other members of the Board were:

Mr. de Skell, *Inspector of the Royal Gardens.*
Mr. Sterler, *Botanist at Nymphenburg.*
Mr. Seitz, *Gardener in the King's service.*
Mr. Hailer, *Id.*
Mr. Hinkert, *Id.*
Mr. Zischl, *Architect.*
Mr. Vogel, *Manufacturer.*
Mr. de Maffei, *Merchant.*
Mr. Zottmayr, *Dyer.*
Mr. Würtz, *Silk Manufacturer.*

The pecuniary affairs of the Board are managed in the ordinary manner, by the General Committee of the Agricultural Society. Resolutions were immediately adopted to require the subscribers to pay the amount of their subscriptions, that the Board might be enabled to pay the price of the twelve hundred mulberry trees, which were expected on that day. It was further resolved, that they should be distributed to those who already had made applications for them; and that the remaining trees should be given, gratis, to all persons willing to plant them; that silk-worms' eggs should be distributed at the same time; and that both these gifts should be granted unclogged with any conditions, as it is expected that they would be employed to the end for which they were requested.

To prevent, however, the blunders which might be committed in the plantations, and the disgrace which might thence fall upon the whole scheme, the two gardeners attached to the Royal Parks, Messrs. Hinkert and Seitz, have volunteered to inspect and direct as well the plantations as the future management of the trees; each of these gentlemen in one section of the neighborhood of the capital, which was divided for that purpose into two sections—the northern and southern. We are inclined to think that this example will be followed in the several departments of the kingdom.

The principal object of the meeting being accomplished, the Board adjourned.

§ 29.

The trees, the cuttings, and the seed, that had been received from Italy, Hungary, and Manheim, and the eggs and the mulberry seed, ordered from Italy, were speedily sent in all directions, together with the printed instruction, and Mr. Nagle's abovementioned memoir.* Fortunately, in a great many places old mulberry trees were discovered, and sixty-nine in the neighborhood of Munich alone. In this way was the third experiment tried in the present year. More particulars are contained in the following advertisement, inserted in the Weekly Journal of the Agricultural Society, (Year 15, No. 7.)

* Theoretic and Practical Instructions for the culture of silk in Bavaria. Munich, 1824.

"Present state of the culture of silk in Bavaria.

"It appears from the statements laid before the Board of the Culture of Silk, in their session, on the 19th of September, 1824—

"1st. That the exertions in this branch of industry, have increased to a wonderful degree; that mulberry trees have multiplied in all directions; and that more seed and silk-worms' eggs have been ordered for the ensuing Spring, (1825;) though the existing plantations could furnish a sufficient quantity of cuttings—the trees imported from Italy, Hungary, and the banks of the Rhine, having perfectly succeeded, as well as the plants derived from the seeds.

"II. That a great number of mulberry trees have been found in many districts of the kingdom, and fortunately saved from the axe, after thousands of them had been felled, through sheer ignorance. Upwards of one hundred thousand had been cut down in one single district, called the Regens Kreis.

"III. That the intelligence procured in different parts of the kingdom, and the facts which may be collected from a survey of the scene under the more immediate control of the Agricultural Society, as well as the present manufacture of Mr. Wurtz, prove that the silk-worms have withstood all the changes of climate, even when not tended at all, as was the case in the dwelling house of the Agricultural Society; and that neither diseases nor mortality have occurred, though the season was very unfavorable, and that the worms had grown to maturity, and had spun their silk.

"It is therefore demonstrated that ovens and close covers, during a thunderstorm are unnecessary; that the insects bear every temperature, and every clime; and that they need nothing but clean and dry mulberry leaves.

"IV. That many thousand of very handsome cocoons have been sent from all parts, and that the silk is not inferior to that of Italy. The Board of Silk Culture have resolved, that this silk should be manufactured by Mr. Wurtz, and that the products, such as stockings, handkerchiefs, ribbons, &c. &c. should be distributed gratis, by way of encouragement to those who had furnished the cocoons."

§ 30.

Greater exertions were made in Bavaria, in the course of the year 1825. A great quantity of mulberry trees, seeds, and worms, and a portable spinning machine, were procured from Italy and Hungary. The official statement in the weekly Journal of the Agricultural Society, was in these words:

"Silk culture in Bavaria, 1825.

"In the session of the Board for the Cultivation of Silk, on the 21st of August, the manufactured articles, such as scarfs, ribbons, &c. &c. were distributed gratis, as a reward and encouragement of the silk-growers, in proportion to the number of cocoons they had furnished.

The Board examined afterwards the results of the culture, within the walls of their own building; and it was ascertained, that, notwithwithstanding the unfavorable weather, the worms had safely passed through all their changes, and produced, at length, the most beautiful yellow and white cocoons.

"The mulberry trees received from Italy, Hungary, and the banks of the Rhine, have all succeeded. The several thousand two-year-old seedlings, and the planted branches, present the same satisfactory result. The mulberry seeds received from Trent had produced plants one foot in height. The seed received from Turin was less successful; and, upon the whole, it is remarkable, that neither the trees nor the seed have suffered at all from the raw weather we had during the Spring, whilst, on the contrary, many forest trees were damaged.

"In order to ascertain more exactly the actual state of the culture of silk in Bavaria, all those who had received mulberry trees, seed, and silk-worm's eggs, were invited to send to the General Committee of the Agricultural Society a detailed report. It must not be forgotten, that the Board pays a florin for each pound of faultless cocoons; provided that a certificate, from a competent authority, be exhibited, stating that it had been obtained from native mulberry trees, and reared in the country. It was, at the same time, made known to all those who might wish to obtain for the ensuing year, either mulberry trees, or seed, or eggs, that they ought to make their applications before the end of the present year, whereupon their request would be attended to, gratis, in the course of the next Spring.

"Upon this, numerous applications of the kind were made; and more old mulberry trees were discovered, in several parts of the kingdom. The demands proceeded from public officers, magistrates, school inspectors, clergymen, schoolmasters, merchants, and agriculturists. It was, therefore, necessary to procure several thousand of mulberry trees, and seed, and eggs, in order to meet the demand; and it was really cheering to observe the zeal which had thus been rekindled within so short a space of time."

§ 31.

The great progress which the cultivation of silk made in Bavaria, attracted the attention of several German States, viz. the kingdom of Wurtemburg, the Grand Duchy of Baden, the Electorate of Hessen, Nassau, Meinungen, &c. &c. In Prussia, the exertions were the greatest; and the newspapers of Berlin, of 1825, contain the following article, which is too important to every German to be omitted in the present treatise: "That the cultivation of silk can be pursued in the greatest part of the kingdom, or, more correctly speaking, in all parts of it, where the mulberry tree thrives, with the same advantages, in regard as well to the quality and the quantity of silk, as to the expenses and the profits, as in the Milanese and in Piedmont, where it has existed only for three centuries back, is sufficiently demonstrated by the experiment tried, upon a considerable scale, in the present year (1825) by the print-seller, A. W. Bolzani. Through

the intercession of the superior authorities, some rooms were given up to him, for that enterprise, in the Hôtel of Invalids. He had rented the trees from the responsible agent of this house, and the hospital; but it was previously indispensable to have them regularly stripped of their foliage, whereby he was, indeed, sure to have a greater quantity of leaves, in the following year, but did not escape for the present, the inconvenience of procuring, at a considerable expense, a provision of them from Kopenik; and, as if the scheme had been doomed to undergo, from the beginning, the severest trials, the weather was unusually rainy, and continued so during the whole season of culture, viz. May and June. But he overcame all these difficulties, as well as those arising from the circumstance, that the scheme was entirely new in this city. He produced upwards of a thousand pounds of extremely well spun cocoons, and will thus have, at the rate of the previous experiments, a hundred pound of fine silk, which will not be inferior to the finest of Upper Italy. This is, it is believed, the greatest profit derived from a private enterprise. Bolzani has shewn himself, in this undertaking, not only a man proficient in all the proceedings long known, but also well acquainted with the most important recent discoveries, the use of which leads to a simplification of the silk culture, a diminution of its expenses, and its more certain success. His greatest merit is, however, that he has tried the experiment, chiefly from a wish of reviving a misrepresented and almost forgotten industry; which, according to the views of its first promoters, the Elector, Frederick William, and King Frederick II. was to be of great national importance; and that he has incurred the great expenses of a first essay, of which the return could not be expected before several years; whilst, in the mean time, he was always ready to assist, with his advice, any person who earnestly wished to attend to the same pursuit. His merits have been acknowledged by the Government, and it is expected that Bolzani will persevere in his exertions, and remove, by a constant success, all the doubts which yet remain in the minds of some persons, in regard to the utility of the national culture of silk. The reeling apparatus deposited in the House of Invalids, will yet remain there in operation a few weeks, and Mr. Bolzani will continue to receive the visits of those who take an interest in the subject."

The Gazette of Berlin of a later date contains also the following remarks: "We are now enabled to give a precise account of an enterprise, so important to agriculture, and of its yearly product. Although Mr. Bolzani had to struggle with many unfavorable circumstances, the eggs ordered from Italy having been hatched in consequence of excessive heat, and the worms having arrived at Berlin when the weather was yet very cold, and when there were yet few mulberry leaves, his undertaking was nevertheless crowned with the most complete success, in the course of the present year. He had ordered 12 ounces of eggs from Italy, which gave him a thousand pounds of cocoons; and from these he obtained a quintal of raw silk, whilst other silk-cultivators (for some sextons in Brandenburgh had not ceased to attend to this business from the time of Frederick the Great,) did not

obtain from half an ounce of eggs, more than 24 pounds of cocoons, which were besides defective. Bolzani obtained from the same weight of eggs, 41¾ pounds of cocoons; and whilst the raw silk of the latter sells at eight dollars a pound, that of the former sells at six dollars only; Mr. Bolzani having procured from the lake of Como, men and women well acquainted with the reeling, his silk is equal to the best of Italy, and can be converted into organzine. According to this statement, the mulberry trees in the garden of the House of Invalids, which previously had not yielded a rent of fifty dollars a-year, produce now a gross income of upwards of a thousand dollars. It is, therefore, demonstrated, that a silk equal to that of Italy, can be produced in this country with greater profit than arise from any other branch of rural industry. It has long since been observed by naturalists, that where the food of an animal grows in open air, and remains during the Winter, the animal for which it grows, is sure to live. It may, moreover, be said, in regard to the cultivation of silk, in particular, that it is not pursued in the southern part of Italy, but in the regions contiguous to the Alps and the Appenines, where the changes of weather are more sudden and more sensible, than in our climate. Even in China, it is chiefly pursued in the provinces situated near the mountains, and where the temperature is very low.

The old Prussian provinces enjoy the great advantage that extensive mulberry plantations, with very handsome trunks, are still remaining from ancient times. Should the cultivation of silk increase to a great extent, the young trees might become a valuable article of trade to the owners of those plantations, as is the case in Italy: and considering that 600,000 pounds of raw silk are yearly imported into Prussia, which occasion an exportation of three millions of dollars, this circumstance alone, seems sufficient to call the attention of every friend of his country, and of every statesman, to Mr. Bolzani's undertaking."

§ 32.

The new awakened zeal for the cultivation of silk, extended even to Sweden. The Stockholm Gazette, of 1825, mentions, "that the "business had again been taken up very earnestly, and that a great "deal of excellent silk had been produced, on a single spot, from "whence mulberry seed, and instructions for the management thereof, "had been diligently sent into the other parts of the country, whereby "that art has been quickly introduced every where. The silk ob-"tained in Sweden, has clearly manifested the truth of the practical "statements which have been published, and are sustained by the "testimony of the Royal Society of Commerce, and of several silk "manufacturers, viz: that the silk which grows near the Polar "Circle equals, in strength and fineness, any species cultivated in "more temperate climates. The Swedish silk has sustained, unin-"jured, the ordinary manufacture and dying, and obtained the bril-"liancy and softness of the East India product."

Last year, (1825,) some Italians acquainted with the art of cultivating silk, arrived in Russia, upon the Emperor's special invitation, and with a view of introducing that art in several provinces of his Empire.

But it made, within the same year, the greatest progress in England, as will be seen from the following article extracted from the Times, of the 27th of May, 1825. "It is contemplated to incorporate in England, by charter, a company for the introduction of the "culture of silk, and for an extensive plantation of mulberry trees. "Mr. Agar, of Camdentown, possesses already, 8,000 white mulberry trees."* In another newspaper, this article is accompanied with the remark, that: "Hence it appears, that the greatest commercial nation, which had already obtained pre-eminence, in every "branch of industry, and in the commerce of the world, does not "think it beneath its dignity, or too insignificant, to try experiments "upon silk, on a great scale, with a view of producing the raw-material, in the manufacture of which, it gains more than half the "value of the products."

The Times of the 4th of October, 1825, contained the advertisement, published under date of the 29th of the preceding month, by the company incorporated by a Royal charter, under the name of "British, Irish, and Colonial Silk Company, with a capital of one millions pounds sterling, in shares of £50." The most distinguished statesmen, noblemen, and members of Parliament, as well as the richest bankers of Great Britain, are among the Patrons, Presidents, Directors, and Officers of this Corporation: as for instance, the Marquis of Lansdowne, the Earl of Liverpool, the Attorney Generals for England and for Ireland, the Marquises of Salisbury and of Downshire, and Messrs. Brougham, and Walker. The company's object, is the cultivation of silk in Great Britain and Ireland,† and the British Colonies, with the exception of the possessions which are under the control of the East India Company, the purchase and introduction of foreign silk, and the construction of silk spinning machines throughout the British Empire: and, to that end, extensive plantations of young mulberry trees have been made in England and Ireland, partly by importations from abroad. Mr. Abbott, the secretary of the Company, mentions, at the conclusion of the advertisement, that 50,000 applications for shares had already been received, and he requests those who might be willing to decline the business, to make it known to him, before the 10th of October.

The new impulse thus given to the culture of silk, was not without effect in those countries where it already existed. Thus Mr. Camille Beauvais, in the House of Deputies of France, during their session of 1825, called the attention of his countrymen to the introduction of

* This passage and the one that follows, extracted from the Times, are here translated from the German—*The Translator.*

† It is stated in an article from Ireland, under date of the 12th February, 1826, that on that day a vessel had arrived from Cette, (in the south of France) with 26,000 mulberry trees, which the Silk Company had ordered for a first experiment in Ireland.

that industry in Great Britain, and the advantages which the English had already gained over France, in regard to the fabrication of silk. "Instead of ten thousand silk looms," said he, "which existed in England ten years since, there are now 30,000; and the weaving of ribbons in the manufactories of Coventry, has increased in the same ratio. In preceding times, the English drew the silk stuffs from Lyons; but at present, they not only import no more, but successfully compete with the manufactories of Barcelona, Valencia, Sevilla, and Grenada, in the South American markets. They import the silk from East-India, though it is of an inferior quality to the silk of Milan and Piedmont. Mr. Beauvais shewed how desirable it was that mulberry trees should be planted, and silk-worms reared, in the northern department of France, and principally of the kind that produced white silk. He further observed, that the French silk products still excelled the English in color and texure, but that the latter had an advantage in their machinery, which enables them to sell at a lower price; but that the most striking fact was, that the manufactory lately begun in Switzerland, Italy, and on the Rhine, (principally) at Elberfeld, almost rendered the superiority of the French doubtful.

In Austria, also, the cultivation of silk has grown into favor. The Vienna Court Gazette, of the 7th September, 1825, contains the following communication: "The Imperial and Royal Agricultural Society, at Vienna, has awarded to the memoir of Mr. Heintl, on the prize question relative to '*The production of provender, in Austria, below the Ens,*' independent of the honorary medal, a premium of fifty ducats, which he has divided into new prizes, for the encouragement of the cultivation of silk; requesting the Society to keep the money as well as the medal, to publish the object of the premium, and to distribute the prizes in due time. Persuaded of the importance of the proposed culture, principally under the circumstances in which the agriculturists find themselves at present in the dominions of his Imperial and Royal Majesty, the Society has accepted the offer of the honorable member, with the eulogium it deserved, and authorized the standing committee to issue the following notice: I. Thirty ducats in gold, and the silver medal, will be awarded as a prize and encouragement to any inhabitant of the territories of his Imperial and Royal Majesty, who in any part thereof, where, in a circumference of three miles, the silk is not already cultivated, shall have produced, in rooms and after the usual method, at least ten pounds of clean marketable silk, within each of the two years 1826 and 1827. Should there be more than one exhibiter, the preference will be given to him who shall have produced the greatest quantity of silk. II. Twenty ducats and the silver medal of the Society, will be adjudged as premium and reward to any inhabitant of the territories of his Imperial and Royal Majesty, who shall have obtained, in the course of the year 1827, at least one pound of clean silk, in the open air, from silk-worms which had spun their silken habitation, when in the state of aureliæ, rent their coverings, coupled, and deposited their eggs upon

the trees. Should there be several competitors for the prize, the preference will be given to the person who shall furnish the greatest quantity of silk. As there are many mulberry trees in the territories of his Imperial and Royal Majesty, the culture of silk ought not to be neglected. Mr. de Heintl describes in his memoir, entitled '*Means of pursuing the Culture of Silk in the open air, and of connecting it advantageously with the usual rearing of Silk-worms in rooms,*' the experiments instituted in the open air, under the direction of the War Department, by the regiments stationed on the frontiers. The principal conditions for obtaining the abovementioned prizes are—1. That the silk must have been produced within the Imperial and Royal dominions, by worms fed upon trees planted within the same. No difference will be made on account either of the province, place of birth, rank, or sex of the person who contends for the prize, and even foreigners may obtain it, if the silk has been obtained under the abovementioned circumstances. 2. The silk thus exhibited, remains the private property of the exhibiter, and a sample need only to be sent to the Society, free of expense, and accompanied with a detailed account of the process of culture employed in its production, and a written reply to the question, '*Whether, in the country where the exhibiter resides, the culture of silk had not been pursued since the memory of man, or how long since it has been discontinued?*' The candidate of the prize must also obtain a certificate of the civil or military authorities, stating the quantity of silk produced by him, and testifying that all the prescribed conditions have been fulfilled: and these papers and the sample must be delivered in Vienna, at latest, at the end of November, 1827, in order that the prizes may be awarded, according to the report made thereupon by the standing committee of the Society, at the next general meeting. The persons entitled to the prizes, shall be made known through the newspapers, and the money, as well as the medal, will be sent to them.

"COUNT JOSEPH CHARLES DIETRICHTEIN,
President pro tem.
"BARON CHARLES DE BRAUN,
Perpetual Secretary.

"VIENNA, *September 1st*, 1825."

§ 34.

It cannot, therefore, be denied that there is a universal disposition to introduce the culture of silk into countries where it previously never existed, and to revive it where the culture, as well as the fabrication, have once flourished, and to carry both to a higher degree of perfection; and, finally, it is of urgent importance to investigate the causes of the success which has hitherto attended this industry, in several countries, with a view of proceeding upon better principles, and to avoid the waste of time and of money which would result from a repetition of exploded errors.

SECTION II.

Of the errors and mistakes which occasioned the decay of the silk culture in Germany, and especially in Bavaria.

§ 35.

In the Austrian dominions silk is cultivated in Tyrol, Lombardy, Illyria, Dalmatia, and a part of Hungary; and that Government strives to introduce it also in the other provinces, with a view of saving the many millions of florins which go abroad for stuffs of that material. The following letter of the Baron de Stainlein, Bavarian Envoy to the Imperial Court, who is acquainted with the subject, and has an estate in Hungary, will throw light upon this part of our subject:

"VIENNA, *February* 25, 1825.

"*To the General Committee:*

"I cannot better reply to your letter of the 8th of the present month, than by communicating to you the Chevalier de Heintl's '*Remarks on the Cultivation of Silk in the open air,*' *&c. &c.*: Vienna, 1815: which contain a full history of that culture in Hungary.

"The cultivation of mulberry trees and of silk in the Austrian dominions, is under the following regulations: By the ordinances of the 12th of April, 1782, and of 6th of April, 1786, a few hundred florins are appropriated, yearly, to the encouragement of the silk culture in Bohemia, which are distributed in prizes to the commonalties which can prove, at the end of each year, that they have planted the greatest number of mulberry trees, and have entered upon the silk culture with some success. By an edict of the 5th of January, 1795, and an ordinance of 23d of February, 1804, it is enacted, that, considering the well-ascertained fact that the Italian silk is inferior to that of Bohemia in neatness and strength, and that the inexperience of the cultivators, and not the climate, had been the true reason of the small progress which that culture had, as yet, made, the competent authorities shall encourage the agricultural corporations not only to provide lands and buildings, but to give the example of reviving this somewhat laborious but profitable industry, and to engage the inhabitants, by all the means in their power, in the pursuit of it; and to warrant to them the purchase of their products by the manufacturers of Vienna, who, indeed, earnestly wish to be supplied with native silk. The authorities of the several circles are directed to make known, every year, all persons who have distinguished themselves most in that line; whereupon, rewards shall be distributed to them, and the weight of the cocoons that may be brought upon the market; to the end that the Government may be enabled to call together a great number of purchasers, and to ensure, thereby, to the cultivators, the greatest advantages from their exertions.

"On the 3d of December, the Government addressed to the Directors of the respective circles a circular letter, in which it is said, that the anterior regulations had not answered their expectations—the silk culture having gradually fallen into greater decay; and that the several authorities had contented themselves to state, briefly, in their annual reports, that no mulberry trees had been planted, on account of the climate, and the prevailing prejudices. Persuaded that neither positive orders nor compulsory measures would produce the desired result, the Government was satisfied with recalling public attention to the regulation issued on the 23d of February.

"The Government communicated on the 4th of August, 1814, to the dominial authorities, information received from a merchant of Prague, by the name of Ranghieri, respecting the progress which the cultivation of mulberry trees and silk had made under his direction during the late year, in that city, and recommending to the said authorities a work published by the same individual upon this subject. An ordinance of the 3d of November, 1815, confirms those that had been previously issued in regard to the slow progress of this culture, and makes it incumbent upon the public authorities to attend, at least, to the preservation of the existing mulberry plantations, and to contribute, as far as might depend upon them, to the multiplication of these trees on the streets, public squares, &c.

"Nowhere does the culture flourish so much, in the whole Austrian dominions, as in the Bannat of Temesvar, where, however, it is pursued at the costs* of the Government, and by no private individual; which may, perhaps, be ascribed to the manifold details of that laborious enterprise, and to the comparative insufficiency of the population.

"I must not, however, omit to mention that the culture of silk has long since been pursued successfully in Bavaria, by the Rev. Mr. Mayer, of Himmelskron, near Kulmbach, in the Circle of Upper Main; and this gentleman will undoubtedly find great pleasure in communicating to the Committee the remarks which his personal experience may suggest for the promotion of this branch of industry.

"BARON DE STAINLEIN."

§ 36.

Mr. Heintl's endeavors to introduce the culture of silk in the open air, had no better success, as might have been foreseen: for they tended to undo what the Empresses of China had so successfully obtained by sheltering and feeding these insects in apartments provided for that purpose. If that culture be still pursued in China in the open air, the difference of circumstances between that Empire and Europe is obvious, and the housed silk-worm is not employed in that culture. How, then, could this insect be so employed in the colder atmosphere of Germany? The exertions of Mr. Heintl are,

* This culture is at present offered for rent, under a guarantee of 20,000 florins, according to a notice inserted in the Gazette of Vienna, of the 28th of February, 1826, in which the annual production of silk is rated at 27,000 pounds weight.

nevertheless, very meritorious, and increase his reputation as a friend and patron of agriculture. We will now transcribe the reports of the Frontier Regiments, inserted in that gentleman's works, and to which we have referred in the preceding pages.

"WALLACHO-ILLYRIAN FRONTIER REGIMENT,

"*Caransebes, August* 10, 1811.

"In conformity to the general order, under date of June 27, 1810, the experiment of keeping silk-worms in the open air, and maintaining them upon mulberry trees, have been instituted by the several companies under the direction of the Inspector Hoesich.

"It appears from the reports of the companies and of the Inspector, that the eggs were exposed to the sun as soon as the worms could feed upon the trees, and that a considerable number were hatched, which were colonized upon a well-grown and sound mulberry tree, in each company: they fed well, and I hoped to be able to rear them; but, at the first shower, they were washed away from the foliage and perished. In a few moments, no trace was found of them upon some of the trees, and, according to information received from some of the companies, these insects died chiefly during the night, and ants and wasps made great havoc among them. On the trees of one of the companies, were found seventeen worms that had already spun their silk, but which were also killed by the rain and strong winds, before they had become butterflies.

"I shall conclude by observing that the rearing of silk-worms in the open air can succeed in those countries and climates alone, where the temperature is subject only to periodical changes.

"I have the honor, &c. &c.

"COLONEL MICHALEVICS."

The report of the Frontier Regiment No. 12, contains nearly the same information as the preceding. "This little family of insects," it is said, "was, shortly after their coming forth, destroyed by heavy rains and strong winds. These worms had, however, sunk into the first torpor at Glogau, Perlasvorach, and Isbitic; and at Grebenaz, they stood out the second torpor, when they were thrown from the foliage, and entirely annihilated by a storm of hail and heavy showers. The same fate attended those of Homoliz, Oppowa, &c. &c. though they had already begun to spin their silk; being, at that period of their existence, lazy and torpid, they were easily thrown from the trees. They suffered, besides, much from their numerous enemies, such as sparrows and other birds, which cause much destruction among them, should they even become inured to our climate, and procreate in the open air. At Starescoa and Pancsova alone, the worms had hung their silk balls upon the trees. Fifteen male and six female moths were found, the latter having deposited their eggs upon the cocoons; and they came to life again after a few weeks; but the moths that had come forth very soon perished.

"But on one thick hedge only, some worms had perfectly grown, made their silk, and deposited their seed in several places, and it is yet visible in about ten of these spots; but in the others, where the seed was exposed to the sun, it came to life, or was evidently eaten up by ants, or destroyed in some other way. The worms had deposited the seed in the same manner as they used to do upon paper, when they were reared in rooms; that is, in irregular forms, close to each other, and not upon the leaves, but upon the bark of the trunk and of the branches. The cocoons were somewhat smaller, and less rich in silk, than those proceeding from the worms that had been tended in rooms. It appears, lastly, from all the instituted experiments, that the climate does *not absolutely* prevent the thriving of silk-worms in the open air: for ordinary rains, though frequent, did not injure their health more than cool nights; they remained healthy and fed well; and this fact refutes the assertion that the silk-worms cannot bear damp and cold weather. It is, nevertheless, true, that the larger and heavier they grow, the more clumsy they are, and that they lose thereby the faculty, common to all moths, to remain unshaken upon trees; and high winds, especially when accompanied with heavy rains, easily throw them down. But it remains to be known, whether the worms proceeding from the seed left in the open air, may not possess the same facility of clinging to the trees; and we must wait for the results of the ensuing year, unless the weather and ants destroy the seed remaining in the ten abovementioned places, before Spring.

"I have the honor, &c.

"COLONEL HORDINSKY.

"*Pancsova, Nov.* 23, 1811."

The Regiment of Gradiska kept an exact journal, which concludes with the following remarks:

"The silk-worms which had lived for some time upon the trees, and died at last, did not feed well; and, compared with those of the same age that had been reared in rooms, attained, in the same time, not a third of their growth in length and bulk, but were somewhat thicker towards the head, and examined in the sun, they were rather rough. The experiment further proved that the worms were not only destroyed by the sudden change of the weather, but partly by insects, such as wasps, flies, and ants. This happened the most frequently in hot weather, in the evening, when the sultry heat had somewhat abated, and the insects were seeking, upon the foliage and under the nets which had been thrown upon the trees, together with the silk-worms, a shelter from the heat and the rain.

"COLONEL MINITINOVICH.

"*Neugradiska, October* 18, 1811."

The journal of the Frontier Regiment of Broda, No. 7, concluded with the following lines:

"On the 12th of July, the eggs of the remaining silk-worms were still upon the trees. Some were hatched by the heat we had to-day,

and the remainder were, as it were, burnt and destroyed; and, as the small worms were unable to eat the leaves, which were nearly full grown, they all died. As there remains no seed upon the trees for the next Winter, the nets have been taken off and laid by till the Spring. The worms that had been reared upon the trees in the open air had, however, been previously in very good health but from the shortness of their claws, they could not well fasten themselves upon the trees, and most of them perished in falling.

"COLONEL MILLETICH.

"*Winkovez, Oct.* 25, 1811."

The reports of the other regiments are nearly of the same purport. The final effect of the experiment was a determination not to try it any longer: and the prize question, mentioned in § 33, was the first means of reviving again the scheme of cultivating silk, in the open air.

§ 37.

We shall here quote the evidence furnished by several private individuals, in regard to the singular fate of the exertions of Frederic the Great, in favor of the culture of silk. An inhabitant of Kuritz states, that the scheme was taken up very earnestly by Government; reports travelled from one end of the Kingdom to the other, like a train of gunpowder. All the towns' authorities, as well as the village communities, were compelled to plant mulberry trees, and to receive eggs, the next year. The newspapers were full of high-sounding articles, &c. &c. But what was the real state of things? The result was as significant as the conception was sound. Regulations were published, in regard to the culture, but every body soon said: "I cannot succeed—the worms die—they have the jaundice." The first distribution of the silk-worms' eggs failed thus, almost entirely: but hope still remained in some bosoms. Several burgesses and peasants asked for a fresh supply of silk-worms' eggs, and resumed the culture in the following year.

There came, from all parts, complaints of a want of mulberry leaves; the moths having been hatched too soon. Others lamented that the trees had suffered much from the severity of the Winter, and asserted that they would never more thrive. Some kept the worms two, three, or four weeks longer; but lost them also, finally, either by scarcity of food, or the jaundice. Insensibly, the culture of silk fell into discredit, and is now in its former neglected state.

§ 38.

Let us see what the well-informed Mr. Knuth says about the culture of silk in Prussia, in his abovementioned work. "Our silk products," says he, (p. 96) "at first undertaken, during the reign of the Great Elector, [Frederic William*] by French Huguenot refugees,

* Born in 1620—died in 1688.

did not amount to more than 13.000 pounds; and even to that quantity only, in one of the most productive seasons. However small this result may seem, and how disproportionate it is to the great expense of money and labor on the part of the Government and the nation, the intention of Frederick II, to procure to the provinces where the climate permitted it, a new source of industry and wealth, must be remembered with gratitude; and it is to be wished that the culture of silk could be preserved in public schools, in honor of that great Monarch, and as an additional means of enlightening the mind of the growing generation, by the observation of an almost invisible insect, which comes forth under the care of man, grows, and, at last, yields a precious and useful substance. The mulberry trees of Italy have not a more beautiful appearance than those that grow about Potsdam and Frankfort. In Italy, also, the crops of silk are not unfrequently destroyed by the weather: now, by late frosts, and, at other times, as, for instance, in the present year, by an excessive heat. But in the Milanese and in Piedmont, 5,000 inhabitants must get their living upon each square mile; whilst, in the circle of Potsdam, (exclusive of Berlin and Frankfort) fifteen hundred only are reckoned for the same extent of territory; and these obtain their subsistence by other pursuits, which would be of a more certain product, were it but for their association with old habits. From this may be deduced the principal reason of the little progress we have, as yet, made in the culture of silk. Our silk was not inferior to that of Lombardy, when prepared in the same manner; and was even considered superior, in fineness and strength, to the products of warmer climates."

§ 39.

This conclusion is somewhat corroborated by further information respecting the previous culture in Prussia. The ill success is in no way ascribed to the climate, but solely to the various blunders that were committed on its introduction; among which, we will only mention the compulsory measures which were employed, at times, and the little care with which the mulberry trees were planted and attended to, and the silk-worms' eggs, and the worms themselves, were treated. The jaundice or the plague would, otherwise, never have made ravages among these insects, no more than among men, if they never wanted food, and never neglected their health.

§ 40.

But the causes of the decay of the culture of silk, in Germany, cannot be more distinctly stated, than in the following report of Count Reigersberg, Envoy of the King of Bavaria, at Carlsruhe; a country where that culture was the most extended, at the time that Charles Theodore governed the Palatinate:

Report of the Bavarian Envoy near the Grand Duke of Baden, to the General Committee of the Agricultural Society, and to the Board for the Culture of Silk, in particular:

"The subjoined copy of a memoir, which Bailiff Hout, of Manheim, has transmitted to the Agricultural Society of the Grand Dutchy of Baden, contains, among other information, the intelligence requested by the General Committee, in their letter of February 18th.

"In transmitting this communication, to which I must, at present, limit my own concurrence, I think it my duty to add, that Mr. Hout is willing to furnish further information, and to supply you with white mulberry trees. I have, moreover, the honor of observing, that, according to my own knowledge, and the information I have been able to collect, Mr. Hout, who resides at Manheim, and the Inspector of Plantations, Mr. Kall, of Swezingen, are the only persons practically engaged in the culture of silk. Both these gentlemen, together with the Aulic Counsellor, Mr. Ziegler, of Manheim, who had previously paid to it some attention, are earnestly laboring to obtain the countenance of Government, for that branch of industry, persuaded, as they seem to be, that they would save thereby, to their country, a large sum of money.

"I had asked permission to consult the papers of the Secretary of the Interior, concerning this matter, in the hope of deriving from them important information; but, as they had not been filed, and as I but recently obtained access to them, it was not in my power to acknowledge, sooner, the receipt of your letter.

"I have the honor, &c.

"COUNT DE REIGERSBERG."

[*Memoir enclosed in the preceding letter.*]

"*Question.* Are any persons still engaged in the production of silk?

"*Answer.* At present, silk is only cultivated at Manheim, in the workhouse, and at Kircheim, near Heidelberg, by a man called Jost Gieser, who has made 40 florins 40 kr. within the present year, by 51 pounds of cocoons.

"*Question.* Was the rearing of silk-worms, previously, a favorite pursuit? Why was it relinquished?

"*Answer.* Silk was, formerly, never cultivated at Manheim, although considerable white mulberry plantations had long since existed in that district. I cannot state the reason. The culture of silk having been introduced in the Palatinate at public expense, and having become, in later times, the monopoly of a company, who has constantly been assisted by the Government, the following remarks concern the whole country, but, especially, the late bailiwick of Heidelberg, where the culture of silk was the most extended.

"This culture had already been introduced, in 1753, by J. P. Rigal, with privileges granted to him by the Government, to be enjoyed until the year 1777. Several communities, and some private citi-

zens, encouraged by these favors, shewed themselves ready to contribute to the attainment of the desired object; and, for instance, the villagers of Kircheim, near Heidelberg, prided themselves, with the Elector, upon their zeal for the culture of silk; proving that they had paid. in the year 1777, their taxes, almost wholly, with the profits they had derived from that industry, and that daylaborers had earned by it, from 60 to 70 florins a year. Nevertheless, a general dislike broke out against it in the community at large, who could neither brook the great favors, privileges, and bounties, granted to some, nor the compulsory measures employed against the citizens in general.

"According to the voluminous documents from which we derive our knowledge, that dislike did in no way proceed from a belief that the climate was uncongenial to the culture, or that the labor, which it requires, was too heavy—those who were engaged in it, beroming rather more attached to it by degrees; but it had its real origin in the privileges by which the abovementioned company enjoyed a real monopoly, and enforced the purchase of their products at certain prices, through the confiscation of all other products, and the forced sale of all the cocoons, at the rate of 30 kr. per pound, under the penalty of fines and bodily punishments. The aversion of which we speak, was further increased by some extraordinary examples of severity, as was the case in the bailiwick of Alzei, where an offence of that nature was punished by a fine of 440 florins 42 kr., and by the appointment of twenty-nine headmen, who received, at the expense of the bailiwick, 30 florins a-year, independent of a relief from some personal and soccage services, of a daily pay of 45 kr., and an additional remuneration of five florins for each hundred of trees that were planted within the boundaries of the community; and over whom were placed special inspectors, who enjoyed the same exemption from personal and bond services, and some other taxes, and received two florins for each hundred of trees, besides a daily pay of 30 kr.

"As it was required to carry the trees from and to Heidelberg, the trouble this occasioned, was another cause of discontent; and the little treasuries of the townships were often roughly dealt with, under the pretence of the advances necessary for the purchase of mulberry trees. Each inhabitant, whether a public officer, or a private citizen, or an owner of an acre of land, was compelled, without any consideration of his circumstances, or any regard to the species of culture to which he had adapted his land, to have six trees upon each acre, within a given space of time. Each new settler was obliged to plant two trees; each villager, one; each individual paying certain taxes, one; all the holders of patrimonial estates to uses, or in trust, a fixed number; and trees were to be planted upon commons, streets, causeways, boundaries, trenches, and church-yards: whereby fifty thousand trees were transplanted, by the inhabitants, from the nursery of the company, within one year. The grubbing and fixing in the ground of the mulberry trees, was the particular

task of the twelve youngest members of each community. Any damage done to the trees was punished, in the first instance, by a fine of ten dollars, and, in the second, by detention in a house of correction. To all this must be added, forest taxes, which presented the remarkable fact that the *per diem* of the foresters considerably exceeded the ordinary price of the young trees that were pretended to be given *gratis*. These burdens were, it is true, taken into consideration by the Government, in the year 1792, and it was acknowledged that the culture itself was not the occasion of public discontent; but that the griping spirit which characterized the compulsory measure of distributing the mulberry trees; the low prices at which the cultivator was obliged to sell the cocoons; and the long list of unreasonable mulcts, charges, and costs, had irritated the people, and rendered odious to them, an industry which, otherwise, would have been so well calculated to please them. Whilst, from 1792 till 1804, many reports reached the public authorities, and many inquiries were made, and a vast quantity of papers was accumulated, the irritated citizens viewed the long delays which the new promised organization experienced, as a revocation of the previous regulations, and endeavored to free themselves, by their own exertions, aided by a concurrence of favorable circumstances, from an industry which, as it appears from the facts stated in the authentic documents, had become a real calamity to the country, by being the offspring of the spirit of monopoly and of tyranny.

"At Heidelberg, Ladenburg, and in that whole neighbourhood, the mulberry trees were felled; and in Ladenburg alone, a plantation of upwards of 5,000 full grown trees was suddenly destroyed.

"The Elector Maximilian Joseph, who succeeded Charles Theodore, abrogated the compulsory system; and with it disappeared all the offences, complaints, and litigations, which it had occasioned.

"*Question.* How much silk was produced within each year?

"*Answer.* Notwithstanding the abovementioned mistakes, the list of which could be increased by the enumeration of many analogous errors, there were, nevertheless, in the country, 110,777 full grown mulberry trees, in the year 1780; and the crop of cocoons amounted to the following quantities:

"In the year	1777	15,024 pounds.
	1784	45,728
	1786	29,249
	1787	17,047
	1789	37,137

"*Question.* How many families lived upon this industry?

"*Answer.* It is impossible to state their number with precision, as the statement, if it ever were made, is lost. It appears, however, from a table made in 1789, that there were few persons engaged in this compulsory pursuit; and that tenfold more would have been produced, had it been left perfectly free. The 37,137 pounds of cocoons, for which the company paid at the rate of 20 rr 30 kr.

would produce, in the present year, at the rate of 48 kr., 29,726 florins 36 kr.

"*Question.* Whither was the silk exported, and at what price was it sold?

"*Answer.* It generally was sent, by the company, to England, where it stood the competition of that of Turin, on account of its strength and general excellence; and, as it could be carried with much less expense to London, than the Italian, the German silk brought a larger profit; but the price cannot be exactly stated: for it varied from one year to another, like that of all other superior products of the earth, according to the abundance of the crops and the general circumstances of commerce. At present the price of a pound of organzine is 16⅞ florins, and of the quintal, 1,687½ florins.

"Tram silk is sold for somewhat less.

"*Question.* What is the amount of capital which this culture brought into circulation?

"*Answer.* This question has already been answered, and I need only add, that a large quantity of cocoons was smuggled into Strasburgh, where they commanded a better price than the company chose to pay. The preceding statement includes only those which were delivered at Heidelburg.

"*Question.* How many mulberry trees were required by the culture which was carried on in that neighbourhood? Of what species were they, and how many remain at present?

"*Answer.* The first part of the question cannot be answered: for the trees were of different ages. Of the immense number that were planted, the peasants left but few to grow up, and perhaps not half of those that existed were made use of.

"According to the statement given above, there were, in the year 1780, 110,777 full grown mulberry trees in the Palatinate. A white mulberry tree, 20 years old, planted in a proper soil, produces, on an average, two quintals of foliage, and about seven quintals are required for 40 pounds of cocoons.

"The mulberry tree, (morus alba,) planted in the Palatinate, had grown from the seed. The trees were not improved by the species which bore large leaves; and only those, the leaves of which were too small, as is often the case with cuttings, were thrown away or used for hedges. Few old trees remain at present in the Palatinate. During our long wars, when the peasants had much ado to provide themselves with necessaries, and to lodge and maintain the enemy, the mulberry trees, which the spirit of devastation respected, fell into natural decay. In most of the villages, the mulberry tree is almost unknown to the present generation. There are yet in the neighbourhood of Kircheim a few old trunks and hedges, or rather the offspring of the old trunks which had been cut down. A good many are yet to be found in the gardens near the palace, at Manheim, and along the causeways that surround the city; and several thousands have been planted, through the care of the institution for the revival of the silk culture, created six years since.

"The last question naturally leads to some further remarks upon what has been done at Manheim, during the said space of time.

"But first we must say a few words upon the possibility of cultivating, with profit, silk in our country, and on the protection which that industry requires on the part of Government. According to long experience, the mulberry tree thrives among us as well as the common fruit trees, and has, besides, the advantage that it bears, without material injury, inundations and spring water. The experience of many years, and the experiments tried in the last six, prove sufficiently that the culture agrees at least as well with our climate as with that of those provinces of France and Italy which, for several centuries, have been considered as the principal seats of the silk culture in Europe. Whilst it failed so completely in those countries during the years 1816 and 1817, that the price of the silk was more than double—the pound selling at 28 florins: we nevertheless obtained good crops, though we had no other food for our worms than the foliage of the hedges. Several French agriculturists, well acquainted with this culture, maintain that the environs of Paris are more convenient for it than the Southern provinces of France*; and it is possible that the climate of our country much resembles that of the great French capital. Hail and oppressive heat, those two great adversaries of the cultivation of the silk, are in our country, more rare than in Italy and France; and frosts in the Spring, which sometimes destroy the foliage of the mulberry trees, are less frequent than the dangerous meteorological phenomena previously mentioned.

"There remains not the least doubt, that we can produce silk as cheap as the French. The cultivator in the Southern provinces of France lives, according to recent information, much better than ours. In the Sevennes, female spinners receive 42 kr. a day, and twiners 21 kr.; whilst, among us, women, well acquainted with that kind of labor, will work for a third of the money. The mulberry tree can, therefore, be planted, and the culture of silk pursued with advantage, in the plains of the Grand Dutchy, and even in the Southern valleys. The silk is at least equal in quality to that of Turin. This is sufficiently proved by the evidences brought together in the authentic documents of an early period. Not long ago, in weaving silk imported from Italy and from Manheim, we found that the weaver, who had been accustomed to Italian and French silk, preferred, by far, the organzine of Manheim, for its greater strength and equality.

* Whilst we were revising the present sheet, we found in the Moniteur of the 10th of April, 1826, the following article, which confirms the remarks stated in the text, and those which will be found in § 33: "The second scheme, relative to the cultivation of mulberry trees, and the rearing of silk-worms, has been for his Majesty a new opportunity for providing, with his usual munificence, a public establishment. A model farm will be opened in the sheep cot, near Corbeil, which has been bought, by order of the King, with a view of trying again the experiments recently made in the Departments of Jura and Allier; and which have triumphantly refuted the old assertion that such experiments can only succeed in the Southern provinces. The increased means of cultivating the mulberry trees and of rearing silk-worms, will tend to free France from the tribute which it still pays to foreigners for a third part of the silk which is fabricated in our manufactures."

"It is known that, in the South of Europe, millions of individuals live entirely, or partly, by the rearing of silk-worms, and the improvement of their precious webs. The female portion of the population, and children, are chiefly engaged in this industry; which thus furnishes means of subsistence to that portion of the population of a country which, everywhere, and principally in large cities, have so much difficulty to provide for themselves, and weigh constantly upon charitable institutions. To this must be added, that the culture of silk gives employment to a great number of hands, the place of which cannot be supplied by machines; and that the labor is pursued in the season when little is done in the fields, namely—immediately before the hay harvest.

"The present low price of all other agricultural products, renders the acquisition of a new industry most desirable, and especially of one which, with the constantly increasing luxury, promises to be an exhaustless source of pecuniary profits. If things could only be brought so far as that the Grand Dutchy were enabled to produce tenfold the quantity of cocoons which a few bailiwicks of the Palatinate furnished to the company, in 1784, the value of this branch of industry would be increased by 30,000 fl. at the rate of the actual price of silk; and averaging the price paid for the reeling and entwining at 1 florin only per lb., there would be a gain of 25,000 fl. for children of both sexes. This valuation is no way exaggerated: for authentic documents prove that the late Palatinate, which constitutes but the third part of the Grand Dutchy, could alone easily have verified our hypothesis.

"The silk-worms feed exclusively upon the leaves of the mulberry tree, of which there are several species. The white mulberry tree is preferable: it belongs to the class that grows the quickest, but needs, nevertheless, from the seed corn, up to the time that it becomes a dwarf tree, or coppice, from eight to ten years, and eighteen to become an useful standard. The *Morus rubra* of America is, perhaps, the most profitable; but we possess not particulars enough about it, to recommend the plantations of this species unconditionally.

"Such a want of information may, also, explain why private individuals have not as yet spontaneously introduced this culture into their country. For more than a century, several sovereigns, from Henry IV, down to Louis XV, applied themselves earnestly to procure this branch of industry to the French nation; and millions were spent for that object, which now produce, and long will continue to yield, a large interest. Even, at present, the Government continues to assist it; and it is not longer than two years since, that the Prefect of the Rhone Department promised a reward of three thousand francs to the community which should rear the greatest number of mulberry trees.

"The facts abovementioned, induced, some years back, Mr. Ziegler, then bailiff, and at present Aulic Counsellor, and the late Municipal Counseller, Mr. Schumacher, to plant white mulberry trees in this district: and, in later times, the Ducal Administration of the Circle was authorized to apply, yearly, a few hundred florins, from the city funds, to a nursery, and an extensive plantation of these trees. Although the directors, Manger, Hinkeldey, Stengel, and Siegel, were

convinced of the utility of the scheme, and endeavored to promote it by all means, they were, nevertheless, unable to devise a more active method of supporting it. In spite of such feeble encouragement, the following results were, nevertheless, obtained under the auspices of the writer of the present paper:

"1st. A nursery of half an acre in extent, in which white mulberry trees are brought up, partly from Italian, and partly from French seed.

"2d. A plantation of coppices of 3,000 trunks, which are encircled by a hedge-row, containing about 4,000 bushes.

"3d. A plantation of about 800 standard trees along the dykes of the Neckar.

"4th. A plantation of 900 standards, 900 in a brush wood, and a hedge row, which encloses 1200 bushes.

"Her Royal Highness, the Grand Dutchess Dowager, having, during the scarcity of the most indispensable necessaries of life, in the years 1816 and 1817, organized, and largely contributed to a charitable society for the support of the indigent classes, an attempt was made, upon the suggestion of the Privy Counsellor and City Director, Mr. Jageman, to rear silk-worms, on purpose to teach this useful art to the children of the poor. The enterprise succeeded astonishingly. In the first year, 157 pounds of cocoons were obtained; from which 13 pounds of organzine were drawn, mostly by those little untutored artizans. The organzine was employed in the fabrication of a piece of velvet, which was presented to the Grand Dutchess by the charitable society.

"Through the assistance of that Society, and a present from the Princess, three excellent carding machines were procured from Piedmont, a mill for linen thread, of eighty bobbins, and a loom for the most delicate species of silk-woof. Her Royal Highness having afterwards become more convinced of the utility of this new enterprise, had recourse to the Government for considerable pecuniary assistance, which was to be applied to the purchase of a house, with a piece of ground of about 15 acres, for a nursery and school of plantation.

"But a change of circumstances prevented these plans and prospects from being further realized; and all assistance is at present limited to a yearly allowance of 400 florins from the funds of the bailiwick, and of 100 florins from the public treasury; which are so much the more insufficient to promote the intended purpose, as the plantations have already attained a considerable extent, and as even these inconsiderable pecuniary allowances have not been paid for two years.

"Should, therefore, the Agricultural Society share my views, respecting the utility of introducing the culture of silk, it might be desirable that the Society should think proper to prevail upon Government to lend its powerful aid, to the end of reviving that profitable industry in this country, where it already once flourished, and of letting it act, henceforth, freely and undisturbed. During six years, we tried all sorts of experiments, and have gone through the whole process of cultivation and fabrication, from the planting of the seed corn of the mulberry tree, to the production of a piece of velvet, which the Grand

Dutchess found beautiful enough to wear herself; and thus we have been convinced that it would be unprofitable to follow the old method prevailing among the Italians and the French, as more than a human age would pass before we could produce silk, should we pretend, like those nations, to employ, exclusively, full grown trees for the rearing of the worms."

"We have tried, with good success, the method proposed by some modern agriculturists; but we want the light of further experience, to determine upon their adoption in this country, and to pronounce, definitively, upon their usefulness. Should the above stated facts merit the attention of the Agricultural Society, the writer will consider it a duty, as soon as he shall have finished some new experiments, to submit to the Society an exposition of a new method of cultivating silk, founded upon the experience of several years, and the combined knowledge of our climate, and of our agricultural system in general: both of which differ much from those of the Milanese and the French.

"We accompany the present paper with a sample of ordinary yellow silk, of white Chinese silk, which is still rare even in Italy and France, and half a yard of black velvet—all products of our own industry, though but a first attempt; and we hope to demonstrate, thereby, the excellence and beauty of our native silk, and the possibility of using it for all sorts of stuffs.

"HOUT.

"*Manheim, September* 1, 1821."

"It is now four years since the writer composed the preceding pages, and after having, in the mean while, collected much additional information in regard to the culture of silk, he is persuaded of the correctness of his statements respecting the possibility of introducing it, with considerable advantage, in every country in which the finest species of fruit trees thrive; having found that, generally, silk prospers better than *hops* and the *vine*; and if, as was observed to him by the Agricultural Society, it has not been heretofore attended with success, in some parts of the Grand Dutchy of Baden, and in the neighborhood of Strasburg, it must be ascribed either to local circumstances, or to the want of skill on the part of the cultivators.

"He intends, upon some future occasion, to develop some further views respecting this subject, which are suggested to him by an experience of four years; and he begs leave to express the wish that this culture, at once so useful and so well calculated for the Grand Dutchy of Baden, and all the provinces of Bavaria situated along the Rhine, the Maine, and the Danube, might obtain the countenance of the respective Governments.

"HOUT.

"*Manheim, April* 6, 1825."

§ 41.

In regard to the culture of silk in Bavaria, and its abandonment, we have the following details furnished by a public agent, who was lately employed in that business:

"By a letter, dated April 1, 1822, the Superintendent of the Royal Gardens has informed the General Committee of Agriculture that the dyer Seyfried, having been one of the public agents employed in the previous endeavors for the cultivation of silk, is perfectly able to furnish them the most correct intelligence upon this subject." "Thereupon, (says the abovementioned Mr. Nagel, in his report,) I went, on the 3d of April, at the invitation of the Counsellor of State, Mr. de Hazzi, in behalf of the General Committee of Agriculture, to Mr. Seyfried's, and conversed with him about an hour, respecting the culture of silk, as it exists at present, and in regard to its previous state. The following are the principal and most important facts thus collected:

"1st. Mr. Seyfried had been attached to the Silk Institution which existed under the late Government, as planter of mulberry trees, rearer of silk-worms, and inspector of the carding and spinning of the silk, with a salary of 350 florins *per annum*, and held his employment for nine years. His Excellency Count Torring-Gronsfeld was President of that Institution.

"2d. Mr. Seyfried planted mulberry trees around the city, which were numbered, grew rapidly to a prodigious height, and were uncommonly beautiful and rich in foliage. It was soon necessary to join two ladders, in order to reach the foliage of the upper branches, which, generally, is the best. According to Mr. Seyfried, there exists still one of these trees, in the garden belonging to Mr. Utzchneider's cloth manufactory, and another in the kitchen garden of the Augustin Friars, who made some trifling experiments in the culture of silk.

"3d. The worms, having been all well hatched and reared, produced cocoons so beautiful and so abundant in silk, that Seyfried gathered, in the first year, 110 pounds of that substance; and the seed for the future breed was so excellent, that there was no need of any foreign supply.

"4. According to Mr. Seyfried, there is less danger of a year's culture being destroyed in Bavaria than in Italy—the higher temperature of the latter country being often fatal to the worms. We keep the worms in the usual temperature, which can easily be regulated in the rooms by a thermometer.

"5. The Government allotted yearly 6,000 florins to the Silk Institution; which sum was taken from the product of the custom-house duties upon foreign silks. The State gained by it 50,000 florins, which it lost, of course, when the Institution ceased to exist.

"6. The decay and dissolution of this establishment must be ascribed to the merchants, who persuaded the Government that they would be ruined, should it longer continue in existence; and that the State, too, would soon discover and feel the disadvantages which it produces. They had calculated, with a true mercantile spirit, that, where silk is produced, manufactures would soon abound, and domestic fabrics would soon increase in value and in price; whereby the price of the foreign commodity must fall, and the products could not be forced upon the purchaser, or sold with large profits. They were listened to, and the

Institution was suddenly discontinued, under the pretence that the culture of silk could not be long continued in Bavaria, and that it was rather injurious than profitable to the State. It was ridiculously added, that the worms were often hatched before the leaves had shot out, in consequence of which whole broods perished. Pensions were granted to those who had been Agents of the Institution; the trees were cut down; the kettles, spinning machines, and the whole laboratory, were broken up, sold, put in store, or thrown away, on purpose that such an institution might not soon be revived. Mr. Seyfried deplored much the decay of an establishment which had produced to the country great and manifold advantages; and he thinks that manufactures will never flourish in Bavaria, as long as our neighbors shall exclude us from their markets, and we, on the contrary, shall receive their products."

A person acquainted with the subject has furnished us the following details, in regard to the progress of the culture of silk at Landshut:

"During the glorious reign of Charles Theodore, the Electoral Regency of Landshut was dissolved in 1779, and re-established in 1784, when Baron Dachsberg was appointed Vice Regent, and, upon the Prince's command, entered into an agreement with some private individuals for the culture of silk.

"The then existing Electoral hop-garden, which occupied a space of eighteen acres, and which, according to the intentions of the Elector Maximilian III, was to be the first hop-nursery of the country, was given up to the new culture; and the present Military Hospital was considerably enlarged, with a view to serve for the rearing of silk-worms. Several sunny spots were selected in the garden, and sown with mulberry trees, which soon grew up so luxuriantly, that, in the second and third year, full and thick hedge-rows could be formed, and several thousand young trees were planted. By these means, a sufficient quantity of leaves was obtained to rear several thousand worms from the eggs which had been procured from Italy. In the meanwhile, with the view of pursuing the culture on a great scale, the plantation was increased one-half of its former extent; buildings were erected at one extremity of the garden, for the spinning and weaving of the silk; and several hundred plants were formed into hedges,* and young trees were distributed gratis to persons inclined to pursue that species of industry, to convents and to agriculturists. The culture was thus enlarged from year to year. By the rapid growth of the trees, there was no longer a want of food for the worms, and leaves were produced in such quantities, that the worms augmented by thousands every year, and the spinning of silk accordingly made rapid progress.

"A dying establishment took charge of all commissions; whereby two weavers could be employed, who furnished all sorts of articles of

* See the ordinance for the introduction of the culture of silk, published on the 26th of January, 1783, (Art. 6.) From some reason unknown to me, the young plants that were employed for hedges were distinguished by the name of *charmilles;* perhaps because they were reared in espaliers, as is the case with the hawthorn, which is sometimes called *charmilles* by the French.

satin and velvet, and knitted as well as woven stockings. Private individuals had already furnished several pounds of cocoons: and such contributions would have become more numerous, had one of the most essential conditions of the progress of the culture been attended to: I mean a sound instruction with regard to the means of pursuing it. In spite of the cold weather we had occasionally during the Spring, and the great cold we experienced during the famous Winter of 1788, which injured considerably the culture, it would still have continued in general favor, had not the war begun soon after, and thrown every thing into confusion. From the year 1789, when Austria sent an army into the Netherlands, the country was constantly overrun by soldiers; and Landshut being situated on one of the principal military roads, the zeal for the culture of silk diminished in that city; and Baron de Dachsberg having died in 1798, the culture and the garden shared the same fate—an utter neglect. The trees were cut down one after another, and but three of them remain in that whole neighborhood. Thus failed so promising an enterprise, which might have been pursued to the greatest and most profitable extent.

LICENTIATE BACKHAUS, *Dyer.*

"*Landshut, January 27th,* 1826."

§ 42.

It appears, moreover, from the papers belonging to the late Silk-Directory, that the decay of this culture must not be wholly ascribed to a hostility on the part of the merchants, as it is asserted by Seyfried; but that the institution harbored in itself the seeds of its destruction: for,

1st. It was a great mistake to have connected, from the beginning, with the production of silk, an extensive fabrication, and to have erected large buildings, stores, filatures, and appointed several officers with salaries; by all which, much money was expended before there existed a single worm, or any means of nourishing it.

2d. No less mistakes were committed in the plantation of the trees; which partly were planted in marshes, upon roads and public walks, and, partly, were wholly neglected in their first growth. This produced diseased trees, or a dirty and dusty foliage, and, as an inevitable consequence, the enfeebling and death of the worms.

3d. On the other hand, public agents, employed in the rearing and feeding of the worms, attended to this business less than persons who would have pursued it as a matter of amusement, or with views of pecuniary interest. Often the worms were not fed at the right time, and little looked to, and the diseased were not immediately separated from the healthy: an epidemic thus spread amongst them, which was called jaundice, from the color which they assumed, and because their whole organization resolved itself into a yellow slime. The disease spreading rapidly, thousands of them perished. It is a well known anecdote in Munich, that, when the Elector, Charles Theodore, insinuated that he would visit the Silk Establishment, at a time that

not one worm remained, the agents ran through the whole city to procure some, by dint of money and fair words; and that a hair-dresser furnished them, at last, twenty thousand, which were immediately carried to the establishment, and exhibited to the Elector, who expressed his great satisfaction, and rewarded the agents for their zeal.

4th. The worms were, moreover, lodged like soldiers in the barracks; a prodigious quantity of them being kept together in one or two rooms. An unwholesome evaporation, the want of fresh air, and the impossibility of moving freely, produced among the worms diseases and epidemics, exactly as it happens in hospitals overfilled.

5th. Most frequently the worms were hatched before the foliage had begun to grow; and millions of worms thus died, as soon as they had come forth.

6th. There was also often a need of leaves in the third or fourth age of the worms, from an impossibility of husbanding the food, and from an erroneous estimate of the quantity which the worms required: for they need such a large quantity from the third to the fourth age, that a deficiency was unavoidable, since there were few trees, and no proportion had been observed between their number, and that of the worms; and a scarcity of food could not fail to occasion diseases among them.

7th. When mulberry trees, and silk-worms' eggs were distributed among the inhabitants of the cities, and of villages, they lacked still—as is proved by the account of what happened at Landshut—a competent knowledge of the proper manner of planting and rearing the trees, and of the treatment which the worms required. Failures produced discouragement, and nobody was willing to think more of the culture of silk. The discontent became greater, from the circumstance that, in most cases, there was no prospect of receiving cash for the silk. The sale of the cocoons was not well regulated: it was connected with difficulties, which amounted, sometimes, to a positive refusal. Large quantities of cocoons, the product of the year 1780, have been sent to the Board of the Culture of Silk in the present year, (1826) in consequence of the offer they had published to pay one florin for the pound of good cocoons. It is true that these cocoons, which have been preserved so long, were partly spoiled by moths, and can only serve for floret silk, but cannot be employed for stuffs.

8th. This concurrence of circumstances, cannot give a favorable idea of the culture of silk, in the 17th and 18th centuries. Instead of an institution fit to promote a new branch of production and of industry, there were but the expensive and onerous measures of the Government, which occasioned a general outcry: and soon followed a long war, which finally destroyed, for a second time, the culture of silk.

SECTION III.

Of the true ways and means to introduce the culture of Silk, to maintain and to promote it.

§ 43.

I shall begin by repeating the opinion expressed in the discourse, I addressed to the Board of the Culture of Silk, quoted in § 28, the correctness of which is demonstrated by the course of events in Bavaria, as well as in China, Greece, Italy, and France, and which flows from the nature of things, and is applicable to every industry. *"No "Board connected with the Government, no particular administra- "tion, no public officers, no expenses. Let the culture of silk be an "affair wholly belonging to the people; an incidental business; the "secondary work of servants, children, paupers, and old people. "Encouraged by the example of Greece, Italy, and France, we "wish to trust it to the fair hands of ladies, who could, by way of "amusement, and without any expense, obtain, within six weeks, a "most elegant material for the ornament of their persons, and of "their apartments."

If the culture grows up in this manner spontaneously, no complaints can arise: it is, then, a voluntary and profitable occupation, unattended by any kind of expense.

§ 44.

No doubts can any longer remain in regard to the possibility of getting forward with this culture, as many facts clearly prove that it thrives in all countries: in those of the South, as well in those of the North. It depends upon two things: upon mulberry trees and silk-worms. The former must furnish the food for the worms; and, when this is provided, the worms need only to be fed, and kept clean, like birds in cages.

§ 45.

It is with the white mulberry tree, as with the fine fruit trees that have been imported from Asia into Europe, and which have grown luxuriantly, and furnish even better fruits, than when in their native clime, as we see in France, in Germany, and even in England. The mulberry tree is long since accustomed to our climate, and is even improved. Experience shews that this tree is less sensible to the cold, than other fruit trees, and that, though it keeps its foliage longer than any of them, it suffers less by late frosts. Even in regard to

* Page 25.

growth, the German mulberry is not inferior. The trees that remain in Prussia, from the former culture, though neglected, thrive luxuriantly; and many of them afford the refreshing shade of old lime trees and beaches.

The same happens in Bavaria, where there are still many beautiful remains of the former culture; but the trees are straggling, principally near Munich, Wurzburg, Köllnbach, Aichstädt, Schönach, Gottafing, &c. &c. The information we have collected, proves that the numerous mulberry trees that were planted forty years since, would still be in a prosperous state, had they not been cut down.

§ 46.

Experience has also abundantly demonstrated that the silk-worms thrive as well in Germany as in Italy and France, and that the climate of Germany agrees better with them: for an excessive heat does them great injury, and it is easier in our country, and in all those of the North, to keep up an equal temperature during the cold weather, which is not unfrequent even in Italy. The former, like the recent experiments instituted in Germany, and especially in Bavaria, shew further, that the silk-worm is less delicate than other species of moths, bearing, without injury, the vicissitudes of the atmosphere. Nothing, therefore, is to be apprehended from diseases and epidemic disorders, if care is taken to provide them daily with a sufficient quantity of clean and dry mulberry trees, and an equal attention is paid to their regular feeding and cleanliness. The cocoons that are thus obtained in Germany, are in no respect inferior to those of Italy and France; nay, the silk manufacturers are of opinion that the German silk is preferable, on account of its greater elasticity; and should the former mistakes in the plantation of the mulberry trees, the feeding and tending of worms, be avoided, nothing would prevent the success of this culture in Germany.

§ 47.

With a view of going methodically into all the details connected with the subject, of which it is our purpose to speak in the present section, we deem it convenient to divide the matter under the following heads:

I, Mulberry trees, and the care they require. II, The rearing of worms. III, The support which Government could lend to this culture. IV, The manner in which a society instituted for the purpose of fostering this culture, could co-operate to its success.

§ 48.

I. *On Mulberry Trees, and the care they require.*

The most instructive essays on mulberry-trees are Bonafous' little work, entitled: "*De la Culture des Muriers*"—Paris, 1824; and the

Instruction which, by the direction of the Board of the Culture of Silk in Bavaria, has been published by His Majesty's gardener, Mr. Seitz. We shall combine, in the following pages, the information which these two works afford, with the most recent observations and experiments.

§ 49.

a. On the Mulberry Tree in general.

At the beginning of the culture of silk in Europe, the black mulberry was principally used; but, upon more experience, it was found, that the white mulberry, [Morus alba. L.] is the only one really fit for this culture. The superiority of the latter consists in its being clothed with leaves 15 or 20 days earlier than the other species. The silk-worms come, therefore, quicker to maturity, and are preserved from the inconvenience of the hot season. The white mulberry, moreover, not only grows more rapidly, but has a more abundant foliage, and the leaves are more delicate, and more nutritive; whence the silk becomes handsomer, and of better quality. But there is a considerable difference in the quality of the white mulberry trees. Count Dandolo, the great silk-rearer of Italy, considers those as the best which grow in Lombardy, under the name of *Folia Giazzola*, and *Folia doppia*, the leaf of which contains five different substances: 1st, the fibrous substance; 2d, the coloring matter; 3d, water; 4th, the saccharine substance; 5th, and the resinous substance.

The saccharine matter is the most essential part in the nourishment of the silk-worm. The more the leaves contain of it, in comparison of the other elements which compose it, the better is the tree adapted to the purposes of the silk culture; and this depends principally on its quality, its size, its age, the process which had been observed in rearing it, and in the dampness or dryness of the season.

Generally speaking, the broad-leaved trees are preferable to those that have small and indented leaves. As botanists place the white mulberry tree in the class of Dioecious plants, or such as have barren or male flowers on one individual, and fertile or female ones on another of the same species, it may be convenient to plant, exclusively, *male* mulberries, which afford the advantage that, not only on stripping them, the berries do not embarrass the operation, or cause a diminution of its product, but that the worms, in their last age, are not exposed to be fed on leaves affected by the glutinous substance of the berries, which would injure their health. Moreover, the male trees keep for their foliage all their juices; whence their leaves are in greater quantity, and of a better quality.

§ 50.

b. Soil and situation.

The nurseries, as well as the large and small mulberry plantations, require a sunny exposure, and spots well sheltered against strong and cold winds. Therefore, declivities descending towards the east or south-

east, and screened by woods or groves, are proper; and, also, all spots protected by artificial plantations and buildings. The trees must never be planted in a marshy ground, nor upon great roads, or in places where they are constantly exposed to the dust: for it sticks to the leaves, and exposes the worms to an unwholesome food. The mulberry thrives upon a fertile and sandy soil; and, next to this, on a calcareous and sandy clay; but a heavy clay, and fenny or marshy earth, are improper; because the bark becomes covered with moss, and the trees are slow in their growth, and liable to diseases of the heart. The disease extends, of course, to the leaves, which become injurious to the worms. A small plantation should be formed on a spot where the trees are the most sheltered, in order that, in case of such late frosts as we had in 1825, the mulberries of that spot might serve as a substitute, until the other trees have fresh leaves. It is a remarkable fact, that, in the same year, 1825, the trees planted along a canal did not suffer by the late frost, whilst all the others were more or less injured.

However, such a late frost as we experienced on the 15th and 16th of May, 1825, is a rare phenomenon. In regard to the hedge rows, they must be formed in such a way as to allow, on all sides, a free access to the air; as experience has proved that a sharp frost principally injures but one side of them. Straw mats, supported by four staves, are an excellent shelter for the trees, and would also serve for the hedges. The dangers arising from night frosts, can, lastly, be completely prevented, if care be taken, on the next morning, to shield the trees until evening from the direct rays of the sun. It is also advisable, after a frosty night, to sprinkle, before sunrise, the trees with cold water. One of these precautions ought, at any rate, to be employed with the reserve trees, in order that the worms might never altogether be without a supply of food.

§ 51.

c. On the Seed of the White Mulberry Tree.

The certainty of obtaining sound and useful mulberries, chiefly depends on the quality of the seed. The best is derived from trees that are perfectly healthy and not too old. The trees selected for that purpose, should not be stripped of their foliage within the same year. If the berries fall towards the middle or the end of the Summer, it is a sign that the seed has ripened, and it should accordingly be gathered. The berries must be thrown into a vessel full of water, and mashed with the hands, to clean the kernel perfectly; and the vessel should be emptied, and filled several times with fresh water, till all the berries are mashed, and the seeds are clean. They should afterwards be laid upon a linen cloth, and dried in some airy place. It might be thought that the seed ought to be immediately sown in the seed-beds; but, to avoid the inconveniences of the raw season, and of the rapidity with which the Winter sometime sets in, it is better not to sow it before the ensuing

Spring. It is to be, in the mean time, mixed with dry sand, and kept in a fresh and dry place, perfectly sheltered from the wind. In countries where there are no tall mulberry trees, at the beginning of the culture, the seed must be procured from Italy or France. From 9,600 to 10,000 seeds weigh about one ounce of our (Bavarian) weight; and 320,000. or at least 300,000 plants may be considered the average product of a pound of seed.

§ 52.

d. Of the raising of Mulberry Trees, and their management in the first four years.

Mulberry trees can be raised—1st, from the seed; 2d, from roots; 3d, from layers; 4th, from cuttings.

1st. *From Seed.*—Although we have said that the Spring is the season of sowing the seed, the precise time cannot be fixed for each country: for it depends upon the climate. But it may be laid down as a general rule, that the young seedlings must not be exposed to the late frosts, which might greatly hurt them. The best time for sowing the seed in Old Bavaria, is towards the end of April. The ground, intended to serve for the seed-beds, must have been broken up and dug, in order that, after having been penetrated by the cold, it might be the more loose and the more fertile. Should this method not have been observed before the Winter, it must be done some two or three weeks, at least, before the sowing. When that time comes on, the earth must be once more well stirred, cleaned, levelled, and divided into beds of four or five feet. Drills of six or eight inches asunder must be then made, with small hoes, and by line. Two days before the sowing, the seed must be steeped in water, and afterwards rubbed upon a packthread, which must be laid in the bottom of the drill, and covered with earth; the drills being made two inches deep in a light soil, and one inch only in a heavy one. When there is any reason not to use packthread, the seed, after having been moistened, should be left to dry in the air, and sown in the drills, which are to be covered with earth, as before directed. The first method is preferable to the latter, because the seeds are regularly sown in lines, and not so close to one another. Should the weather be dry during, or shortly after, the sowing, the beds should be watered immediately after the seed has been sown, and for some days afterwards, to promote its vegetation. The seed generally begins to sprout within twelve days, when sound; and no alarm need be felt if it should be later, as was the case in 1825, when three weeks elapsed before the plants appeared. The beds must be kept clear of weeds, which would retard the growth of the plants, and be defended against the frosts, which could destroy all the seedlings in one single night. To guard them against such dangers, it will be prudent to strew upon the beds, fir or other evergreen twigs, which may be left upon them until frosts are no longer to be feared. They serve, also, for the seed-beds, as a good defence in raw weather, when the winds are from the

north or the east, or when the sun is very hot. In countries, therefore, where similar atmospherical influences are apprehended, the beds are to be sheltered in the manner abovementioned; but the twigs should not be laid too close upon the beds, for fear of suffocating the seed. They might, also, be covered with mattings, or with chopped straw, in order that the shoots may be sheltered, as soon as they appear. It is less advisable to raise seedlings in hot-beds, because they are then more liable to injury from exposure to the open air. Their growth may be promoted by leaving to the shoots, at first, but one bud, which would be nourished by the whole sap, and the main stem then becomes straighter and stronger. This must, however, be done with great caution, and before the plant comes into leaf: for the proposed method might, otherwise, occasion more evil than good. If the young plants appear crisp, the lateral shoots should be lopped, to leave to the principal sprout its whole vigor. The plants must be watered during the Summer, and cleared of weeds. If the surface of the beds harden, or grow dry, it ought to be stirred between the drills, to render it more permeable to heat and moisture. Towards the end of August, or the beginning of September, a rich and fat soil ought not to be watered; otherwise, on one hand, the second springing of the young plants might be too much forwarded, and, on the other, the plants might be unable to ripen their wood before the ensuing Winter. Before the beginning of that season, the seedlings should be covered with dry leaves, to the depth of about a foot; and it must be spread in the interval of the lines of plantation, in such manner that the seedlings be buried, as it were, under the leaves, and but little be perceptible above the ground. Such a covering acts most beneficially upon the seedlings, especially in great frosts without snow, when the ground becomes contracted, splits, and cracks; then the cold, penetrating through the interstices, injures, and sometimes destroys, the tender root. A fat soil of clay is the most liable to this danger. If the seedlings have not grown to much height, nor very close together, during the first Summer, they must be kept two Summers longer, after the method that has been described, and be covered again in the Winter with dry leaves. But, if they attain the height of one foot, or a foot and a half, or if they have grown very near to each other, they ought to be thinned, and transplanted in the second year. This will prevent the loftier from injuring the smaller trees, and the roots of the latter from spreading too much, which would become the more hurtful to their further growth, as they could not be transplanted before the third year after their sowing. But it might be still more advisable to uncover, carefully, the beds, and to take up the seedlings, without, however, breaking the roots, and to divide them in two classes, according to their size. The stems should then be cut, as far as they are damaged by the frost, so as to remain about three inches above the surface of the ground, and the root should also be shortened somewhat. The ground having been, in the meanwhile, laid out in seed-beds, as mentioned above, the tall seedlings should be planted together in one spot, and the shorter ones in another. The former ought

to be separated from each other by such distances as would allow them to grow undisturbed for some years, viz : on a ground four feet wide, in three lines, at the distance of one foot and a half from each other. The smaller plants might be placed six inches apart, in four or five lines, on a ground four feet wide : and this, from the consideration that, should they be again too near one another, in the second or third year, it would be easier to thin them, and to remove a part to other beds, without injury to the others.

The roots of a plant of one year being yet delicate, it will be better to put them in the ground with a planting-stick, along a line, than with a shovel. They should be planted a little deeper than they had been before : for a mould recently stirred sinks somewhat, and the seedlings would, therefore, be too high above ground. They should be watered as soon as they are transplanted, in order to bring the earth in closer contact with the root. These beds must be managed, during the Summer, like the seed-beds, viz: they must be cleared of weeds, and watered in dry weather, and, before the Winter comes on, they must be covered again with dry leaves, which are to be removed in the following Spring. Before the seedlings begin to bud, all the wood affected by the frost must be cut off, and the ground ought to be carefully opened and stirred, without injuring the roots of the seedlings The same is repeated the third Summer, with the exception of watering In observing this method during the abovementioned space of time, the young mulberry trees will gain strength, and, after three years, be fit for hedges. But the plants designed to become standard trees, for which purpose the handsomest and straightest stems should be selected, must be planted anew, in lines, two or two feet and a half asunder, after having been pruned as above directed, and must be well watered. They are then left to grow seven or eight feet in height; the lateral branches along the main stem are shortened, so as not to leave more than two or three buds, which finally are nicely trimmed in the ensuing Spring: for as long as the branches remain small, and but a part of the sap is necessary for their nourishment, the stem grows uniformly strong, thick, and straight, without need of a supporter, and the head developes itself in a fair proportion with the trunk. When, on the contrary, all the branches are lopped off close to the stem, not only the favorable results which have been mentioned are lost, but the places where the cuts have been made, are blighted, and the death of the tree is often the consequence. These plants, when they thrive, should remain in the nurseries until they have grown up into handsome standard-trees, and are then transplanted in the spots for which they were intended.

2d. *From Roots.*—When three or four-year-old trees, that have not well grown, are cut half a foot above the ground, from four to six suckers spring from that part of the old trunk which is next to the ground. They take root; and, that they may do this more quickly, the mould should be heaped up on both sides of the trunk, and the beds should be hoed in the middle of the Summer, and should be wa-

tered diligently in dry weather. In following this method, young plants may sometimes be separated successfully from the old roots; and if this be done, after the second year is elapsed, the stems are still handsomer and stronger. In this case, all the trees should be pulled up, the young sprouts should be nicely lopped or torn from the old trunk; and, if the latter is yet serviceable, it might again be put in the earth for the same purpose, or, if not, thrown away. The pruned roots must be properly cut, and may be managed like the seed plants that are two or three years old, and used in different ways. This is consequently an additional method of increasing the number of mulberry trees.

3d. *From Layers.*—Such an increase is further assisted by layers. Whilst in the Spring the sap begins to rise, the branches of low trees may be bent down to the earth, or young and elastic stems, well provided with branches, may be bent and fastened down with hooked pegs; the branches are then buried in the ground, where they also should be fastened; or several young stems fit for this purpose may be placed in the earth obliquely, that they may be bent with more ease and safety, and all the branches are then laid under ground, as above directed. The ground around the mother-trees should be prepared in such a way that the water may run off. Great care must be taken in bending the stems or the main branches, as well as with the laying down of the smaller branches, to prevent their breaking. As soon as the layers have put forth roots, which often happens in little more than a year, they may be separated from the mother-tree in the ensuing Autumn or Spring, and taken out from the earth; but this must be done with great care, to prevent the young roots from breaking; and the further process is the same as prescribed in regard to three-year-old seedlings.

4th. *From Cuttings.*—In this method of raising mulberry trees, use is principally made of the two-year-old branches, procured by pruning the standard trees, or they are for this express purpose cut from sound and well-grown trees, even if no more than a year old. The branches are cut in equal lengths, from ten to twelve inches; and they are thus placed into the ground, prepared for the purpose, at a distance of three inches from each other, and so deep that the branch rises above the ground not more than three inches, and the mould is pressed around it. It should then be watered, and the bed should be levelled. A bed four feet wide is sufficient for four rows of such plants. The cuttings must be frequently watered in dry weather, with a view of hastening the formation of roots.* As sometimes but half of the cuttings succeeds, the ensuing Spring should not be permitted to pass, without placing others in the room of those that have failed, or without placing some that are already furnished with roots. The space which the uprooted cuttings had occupied, may also be left

* Several very successful trials of this kind have been made, within the last year, in the garden of the Agricultural Society.

empty, whereby those that have thriven, will more easily put forth their shoots, if the proper care and management have been observed during the first year's growth of the seedling.

These are the four methods of raising and propagating the white mulberry tree. The first is the most proper for the raising of beautiful and durable trees, and of standards; and the other three furnish only plants fit for hedges, from which, however, much profit is also derived.

§ 53.

e. Of the grafting of Mulberry trees.

Benafous observes that there is yet a difference of opinion in regard to this method, as some think it advisable to graft the young trees, whilst others prefer to leave them in their natural state.

It must, however, be admitted that the grafted ones lose none of the properties inherent in the wild mulberry raised from the seed, and that it is improved and variegated by the grafting. It is farther to be observed, that, upon the discovery of a finer sort of mulberry, the grafting alone is able to communicate its qualities to other trees, and to procure better leaves.

It is not an unessential precaution to give to all the silk-worms food of similar quality; and grafting, only, can render all the leaves equally good. The best methods of grafting mulberry trees are the *pipe grafting* and *the budding*, (*en flute ou chalumeau, ou en écusson à la pousse.*) The latter is quicker done, but the other agrees better with the sprouts, being less exposed to strong winds. The budding rarely succeeds with mulberry trees. The pipe grafting is as follows: you make a circular incision through the bark, and slip it off, and you substitute for it the bark of the tree from which you graft. If the cylinder which you mean to put on is too large, you must cut it until it fits exactly the part in which you intend to place it; and if it is too small, an additional piece must be cut from the same branch, with, if possible, one bud upon it, and it must be secured by the ordinary mode. The budding is done by taking off a bud, with the bark, as soon as the tree is in sap, and by inserting it in the opening which has been made in the tree intended to be grafted. The most essential thing in this operation is to effect the closest contact between both barks, in order that their tender edges may be closely united. You may also employ *crown grafting*, [*la greffe en couronne,*] after the mode usual in Lombardy. It might be conveniently resorted to for crooked hedges, or such as have been injured by animals. Young mulberry trees, the diameter of which does not exceed two inches, are cut near the ground, and are thus grafted. Within the first year, they produce handsome sprouts, which again clothe the hedges. Persons well acquainted with the subject, advise also to graft young mulberry trees, where they were sown: for, if they are carried afterwards into nurseries, they produce plants equal in strength and growth.

But, if, on the contrary, they were only grafted in the nurseries, it often happens that those the grafting of which has failed, must be grafted again the following year, and that they are shaded and injured by the adjoining trees that have succeeded better. Those who do not follow this method, ought at least to graft the young trees in the nurseries, and not when they have been placed in the spots for which they were designed, because they can be better tended in a small space, than where they are dispersed. While in the nurseries, they are, besides, still of a suitable age to be *grafted near the roots, (au collet des racines,)* which method is better than the *grafting upon the branches;* but this cannot be done so safely when the trees are planted out, because the sprouts near the ground might easily be injured.

In the second Spring after the sowing, as soon as the buds begin to swell, the grafting branches must be cut from the best trees, and the best are those the buds of which are handsome, and close to each other. To preserve them, they must be in fresh, moist earth, in a northerly situation, and two or three buds are left above the ground. As soon as frosts are no longer to be feared, these branches are engrafted upon young trees which are about 18 lines thick, after the stems have been cut off as near as possible to the ground. Rain and winds being injurious to the graft, the finest weather should be selected. But, if the plants are yet too feeble in the second year, they must be pruned, and the grafting must be postponed till the next Spring.

The experiment of grafting has not as yet been made with wild mulberries. Some recommend the *Prunus Mahaleb*, which Duhamel generally proposes for the improvement of all fine stone fruits. But the question is, whether the silk-worms can feed upon the leaves without injury? Several trials should be made.

§ 54.

f. Of the form of a Mulberry Plantation.

There are two methods of planting the young mulberry trees, or of forming large plantations, viz: 1st, in *hedges;* or, 2d, as *standard trees.*

1st. *The planting in hedges* affords the advantage that the leaves can be immediately employed for the feeding of the worms, because their vegetation is quicker than that of standard trees. To form such hedges, you should take plants two or three-years old, or such as are not fit for standards, plant them three feet asunder, after having properly pruned the branches and the roots, and keep them from five to six feet above the ground. The leaves ought not to be given to the worms during the first two years, but should be left untouched; but the young plants must, at the same time, be kept clear of weeds, and well watered in dry weather. In the Spring, the dead branches ought to be pruned from the living wood, with sharp hedge shears, and it should be endeavored to give a certain form to the hedge by such yearly cuttings. Another method of planting hedges, consists in placing

plants, two or three years old, at a distance of one foot and a half or two feet, taking, however, care that the two lowest buds be in the direction of the line; and the plant should be cut down to these two buds, about half a foot above the ground. In the course of the Summer, they will become two beautiful mother-branches; and, in the ensuing Spring, one of these is to be pruned down to one foot, and, always, upon only one side of the plant, be it the right or the left side; and the branches of the opposite side must be left untouched as far as they remain green. These latter branches are then bent in the direction of the hedge, towards the lopped branches, and fastened to them with willows, so as to form an arch.

In this year, the third of the plantation, a multitude of branches shoot out along the mother-branches, which must be trained on both sides, in order that the hedge may be brought into a regular form. If the branches are too young, it will be better to cut them only in the following Spring. If any stem should die, it must be replaced by another, to prevent a vacancy in the hedge.

The leaves can be pulled for the nourishment of the worm in the third Summer. Such a mulberry hedge might also serve as a fence for gardens, meadows, and so forth, and be substituted for hedges of barberries, wild roses, &c. &c.; but, as has been said at the beginning, the situation and the soil must always be taken into consideration.

2d. *Standard plantations* can be formed in several ways; either by a regular or irregular distribution, or they may be formed in hedges. In the former case, they ought to be at least 18, 20, or 25 feet asunder, in order that the trees might spread freely on all sides, and that the ground might be used in some other way; experience demonstrating that the shade of mulberry trees does not injure the field or garden plants, which grow amidst them. If the standards are to be formed in hedges, they are to be placed within the hedge; from 24 to 24 feet a standard is planted, and, in the space between, seven lower trees should be put; or, if the standards are 30 feet from each other, which is still better, nine of the other sort may be put between. The standard must then be eight feet high, so that its branches may meet those of the adjoining smaller tree, and they may live simultaneously, and share together, undisturbed, the salutary influence of the sun, the dew, and the rain. Such a plantation is preferable to that of the other kind, by affording not only an earlier but a more abundant crop of leaves: for the worms may be fed, in the first period of their life, with the leaves of the hedge, and in the second with those of the standards; whereby neither of the trees would be too much exhausted, and might be serviceable during the whole year.

The preparing of the soil must be carefully attended to, in both methods, previous to the plantation. This must be done before Winter, not only on account of the reasons already stated, but also with a view that the labored earth might sink to its proper level during the Winter. In spots where mould is not in sufficient quantity, there must be gathered enough of it to have it at least three feet deep; for

the trees would not thrive in a shallow ground. The ground ought, therefore, to be divided, in the Autumn, into regular lines, and the places where a standard is to be placed, ought to be marked with a stick, around which a circle of about eight feet in diameter should be broken up, down to bad ground or gravel; and, if the mould lies deep enough, it ought again to be thrown up, in order that the upper part, or the turf, should remain at the bottom of the mound. If there be so little mould; if, for instance, it be no more than 12 or 15 inches deep, about a foot more of gravel must be thrown out, and replaced with good earth, and the mound must be raised a foot above the general level, in order that the tree, which is to be planted, be at least three feet under ground. If the digging out of the gravel were to be omitted, on account of the expense, the deficient mould, if the ground be not too shallow, may be laid upon the surface; but a mound raised in this manner, must be at least ten feet in diameter, and three feet deep. But this method cannot be much recommended, from the danger of the dryness, heavy winds, &c. &c. It is also advisable to keep them clear of grass. For the hedge plantations, the ground should be broken up five feet wide, and to the whole depth of good earth; or you may dig, where the mould is wanting, a trench five feet wide, and from three to four feet deep, and fill it with good earth; and, if the earth of the mound, as well as of the trench, have sunk too much, fresh earth must be thrown up to raise the ground to the proper height. The same method is to be observed, as has been mentioned already, in planting, and the trees must be well watered as soon as put in the earth.

If the standard trees are not strong enough, or if their heads are too large to stand without support, stakes ought to be fixed close by, to which they must be fastened with willow; and it will be well to do this before planting the trees. It must, however, be observed, that they must be fastened loosely, in order that, in case the earth should sink, they might have space enough to follow gently that movement; because, otherwise, they would come to stand above ground, and their roots would remain naked. Care must also be taken not to rub, or injure the bark.

§ 55.

g. Of the conservation and further management of Mulberry Trees.

In some countries the grown-up mulberry trees are left to themselves; in others, they are more or less pruned. Both these methods are more founded upon custom, than upon sound principles of rural economy. Three things ought to be kept in view:

1st. The quality, and the quantity of the leaves.

2d. The duration of the trees.

3d. The facility, and the certainty of the gathering of the leaves.

Any method adopted, without regard to these primary conditions, is dangerous, or useless. The clipping of the trees contributes undoubtedly to render the leaves more numerous, and larger; but, if it be

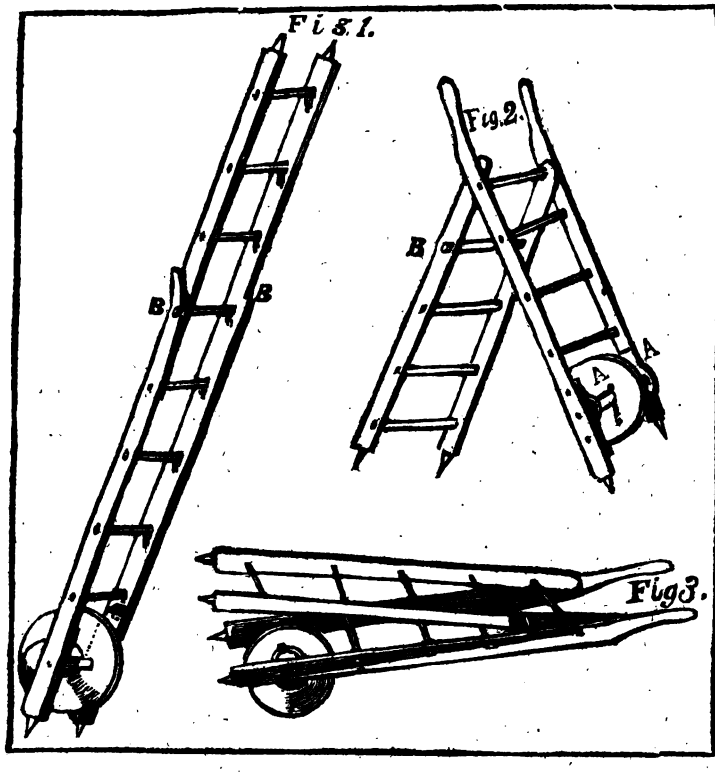
done at an improper time, or imperfectly, the leaf not only becomes less nutritious, but diminishes in quantity. We shall not, at any rate, recommend the method sometimes adopted, by which the lateral branches are cut every three or four years, leaving the principal ones alone. The leaves may thereby become larger, and the crop more abundant; but the worms will have a poor food; the trees lose their strength, in proportion to the number of their wounds; their natural growth is checked, and their life is shortened. Trees left to themselves, have a thin foliage, the leaves are small, and it is difficult to gather them. A blunder committed in the pruning, might destroy a tree, but the cutting, itself, is not necessarily hurtful. Much caution must be observed with the pruning, in the first year, that the leaves are plucked; and the pruning must be executed, so that, by an equal distribution of the sap, there may be a perfect equilibrium in all parts of the tree. Consequently, after the gathering of the leaves, all the branches that had been damaged in that operation, and all the dead ones, ought to be lopped off, as well as those the vegetation of which seems too low; and those the vegetation of which, on the contrary, is too luxuriant, ought to be restrained in that propensity, or trained in an oblique direction, which is a means of restraining a too rapid growth: the tree ought not to be left to grow to an excessive height, nor to spread too far; the branches which obstruct the development of the head, or hang too much down, should be shortened; and, lastly, those that have been thrust out of their natural direction, during the gathering of the leaves, ought to be set right again; and, for the rest, the ordinary treatment of fruit-trees must not be lost sight of.

The precautions recommended here, in regard to trees, are applicable also, to hedges, as has already been premised in § 54.

k. Of the pulling of the Leaves.

Much depends, in regard to a long preservation of mulberry trees, and mulberry hedges, on the method of gathering their leaves. It should be done with the greatest care, to prevent the trees from receiving injuries; and caution is so much the more necessary, as nature has not intended they should be stripped violently of their foliage. It is essential that *all* the leaves should be pulled off: for, if any remain on some branches, they attract the sap, whilst the naked branches are incompletely nourished. Begin by pulling the leaves of the hedges; then proceed to the young trees, whereby the latter gain time to come into fresh leaf, and the sooner, in proportion as the leaves of the older trees are more fully grown, and more nutritious. These are the most proper for the worms. The stripping of the leaves should not be begun before the disappearance of the dew, and ought to be concluded before the setting of the sun. The hand should move from below upwards, in order to avoid pulling off the buds, though it would be easier to strip them in the contrary direction. All climbing upon young trees must also be avoided: for their branches are

tender, and break easily; the best way is to use the rolling ladder, of which we give here the design.



It consists of two parts: a wheelbarrow, the legs of which are from seven to eight feet long, straight, somewhat projecting beyond the wheel, and connected by four cross sticks; and a ladder, six feet long, which is attached to the wheel-barrow by the fourth cross stick: with this apparatus, a single man is able to carry several bags of leaves. It forms, when only half displayed, a double ladder, as it is used in pulling the leaves, for the tree must never be rubbed; when displayed in its whole length, it is like an ordinary ladder, from 12 to 18 feet long. The pointed iron, with which one end of each of the legs is shod, serves to give to the ladder a steadier position. This apparatus may serve besides for every other sort of fruit trees.

The bags should be hooped, in order to remain open, and ought to have a hook, that they might be hung on the branches; care must be taken that the leaves do not fall on the earth, and that the bags be not emptied on the ground, especially when it is not very clean or clear of dust: when conveyed on the wheel-barrow, they ought to be kept sheltered from the sun. Leaves covered with a tough, viscous matter—the honey-dew, as it is called—are injurious to the worms; they

must be used only in case of great scarcity, and must then be carefully washed and dried. Rusty leaves have not this inconvenience, because the worms eat only the healthy portion. In some countries, mulberry trees are stripped of their leaves, in the abovementioned manner, to procure food for the cattle: this is a very bad custom; such a double tax upon these trees, exhausts, and soon destroys them. The best method to preserve them, and to keep them long in leaf, is to leave a portion of them untouched, every four or five years. As it is all-important to have always a supply of dry leaves, and as rains sometimes continue long, it will be well to have some trees under shelter: to this end, fasten three or four hop sticks loosely together, above the tops of the trees, in form of a pyramid. so that they are from six to ten feet apart, upon the ground; on the top, fix three or four hoops of a size corresponding to that of the tree, and cover them with straw, as in thatching a house. You obtain, in this way. a light, cheap, and moveable roof, which will preserve the trees from the rain. With a provision of such roofs, you can quietly wait for the rainy season, and be sure to have always wholesome and dry trees. But there are means of drying leaves, which cannot avoid becoming somewhat moist, in consequence of a continued rain. Spread them in parcels on a clean linen cloth, in a dry room, stir them often, with a rake or a fork, shake the cloth. and the leaves will soon dry. Dusty leaves must be cleansed with clean linen.

§ 57.

i. Of the other advantages that might be derived from the Mulberry Trees.

The fruit can be eaten, (the white less than the black,) and converted into syrup or vinegar. As the wood resists moisture, it can be advantageously used for pails, hoops, casks, and all sorts of turner's and joiner's work. Paper and fine pack and sewing thread can be manufactured from the bark, and the leaves furnish good food for sheep and goats.

§ 58.

k. Of the enemies of the Mulberry Trees, and a protection against them.

The principal enemies of the mulberry trees, are hares, deer, and mice. In places where these animals exist, it will, therefore, be prudent to cover the trees, before the Winter, with straw, reed, or sedge, and to leave this covering, until danger is no longer to be apprehended; and, in the mean time, it will shelter the trees from the frost, if it is extended to the head. It may be useful, even in the Summer, especially if the trees stand in a sandy soil; because it prevents the rapid evaporation of the sap, and preserves longer the refreshing dew. The nurseries must be particularly defended against the danger of which we speak. They should, therefore, be raised in close gardens,

or be surrounded by a tight fence. Against mice, the usual remedies might be resorted to; and, if, notwithstanding all these precautions, the trees are injured, either by mice, hares, hail, or an unskilful plucking of the leaves, and the branches or the bark have been hurt, the wounds should be smeared with the cement hereafter described, and dressed with old linen, if the wounds be large, or if the bark be loose. It will be found, after a while, that not only the wounds are perfectly healed, but that the old bark that was broken, has become perfectly smooth. The cement is, therefore, an excellent remedy, also, against the canker, blight, and other diseases to which the bark is liable. If they consist, however, in a slow and poor growth, the tree should be cut down to the mother-branches, and an attempt should be made to improve the upper mould, (if it be presumed that it contributed to the disease) either by some old manure or good earth.

I have heard of a species of vermin, resembling bugs, that have been seen, in different years, upon mulberry trees, and from which the leaves became hurtful, and even fatal to the worms; and two remedies have been proposed: to sprinkle the tree with soap-water, or to smoke it with dry ox-dung. The disease arises, perhaps, from mere neglect. The cement to which we referred, is the one invented by Forsyth, and can easily be made: take 16 parts of cow-dung, (or such as contains no litter) 8 parts of old mortar, 8 parts of wood ashes, and 1 part of river-sand: the dry ingredients must previously be sifted through a fine wire sieve; the whole must then be diligently worked to a thick unguent. Instead of cow-dung, ox-blood may be used; and instead of mortar, chalk. After having thinly smeared this unguent upon the diseased spot, the surface must be rubbed perfectly smooth with a powder, six parts of which must be wood ashes, and one part burnt bones, or chalk. This, however, should only be done in dry weather, in order that the unguent might dry quickly, and cover the wounds with a crust; and, as it does not stand long, there must not be more prepared of it, than is required at a time: but, if it is intended to be kept, it must be moistened with urine. In Forsyth's hands, it became a universal remedy against all the diseases of trees and plants; and he was, accordingly, richly rewarded by Parliament. Every intelligent gardener in Germany, is probably convinced of the efficacy of this remedy.

§ 59.

II. *Treatment of the Silk-Worms.*

The illuminated plate,* annexed to the present work, represents the series of changes, from the formation of the egg to the death of the silk moth. We shall explain it with reference to the figures that are marked upon it.

* This plate was drawn upon a clever exposition of all the parts of the silk culture *in natura*, by the gardener, Mr. Seitz, which he presented to the General Committee of the Agricultural Society.

§ 60.

1. *The egg, or the development, and birth of the Silk-Caterpillar.*

The dark grey eggs are yet undeveloped: but the white ones have their worms already hatched; and, for that reason, such a little insect has been drawn close by. Here begins the silk culture; we must, therefore, speak, 1st, of the place where the worms are reared; 2d, of the proper time of beginning the breeding; 3d, of the further preliminary process; and, 4th, of the coupling of the moths.

I must, however, previously observe that till a very recent epoch, every thing was uncertain in this culture, and that Count Dandolo* succeeded, by experiments pursued for many years, in reducing this art to exact principles, and in throwing much light upon it. The culture of silk has thus been reduced into a system, and Bonafous has hence been enabled to publish his second work, entitled *De l'éducation des Vers à Soie*: Paris, 1821. By means of that work, combined with the experience derived from the most recent exertions, in Munich, for the culture of silk, and other data, we are enabled to bring together, in the present pages, in a didactic form, all that relates to this useful art.

a. Persons who intend to pursue the silk culture, upon a large scale, should erect a building after the model proposed in the abovementioned work. But, as I have repeatedly said, I mean only to speak of the *popular pursuit* of it, as the incidental occupation of females of all ages, of children, and of old and poor people, and which, nevertheless, produces great results, as well in regard to the number of worms that would be reared, as the fabrication of the silk.

This popular pursuit requires no express buildings or institutions, which never fail to be expensive, and which, like military barracks and hospitals, never thrive. I speak of the culture of silk as an incidental occupation, which can be pursued in ordinary rooms; and the Agricultural Society had no better laboratory for it than their public office. But the rooms ought to be dry, and sheltered from the extremes of cold and heat; as the worms dislike dark rooms, they ought to be sufficiently lofty and light. The windows should be left open, when the weather is fine, to refresh the room; but never when it is windy, or when it rains. Air holes of 12 inches square, with moveable slides, will be very serviceable, and they ought to be made near the top of the room, or under the windows, or at the doors, near the floor. The exterior air penetrates through the lower holes, and

* He made these experiments upon his estate, Varese, near Milan, where he opened a real school for the silk culture, and where he gathered around him some young men, to whom he read lectures on this art. We refer the reader to the Count's work, entitled *Del arte di governare i bachi da Setta*, del Conte Dandolo: Terza ediz. Milano, 1819. The Count died the 12th of December, 1819. His laboratory still exists at Varese, and has been imitated in several places. It is indeed a perfect model: the Italians call these laboratories *Dandolieres*, from gratitude to the person through whose instruction the crops of silk have been increased tenfold in Italy, and who has secured to his country an abundant source of wealth.

carries off, through the upper openings, the air, which before filled the rooms. The number of these holes must be proportioned to the size of the rooms. Experience shews that this is the best means of renovating the air of an enclosed place; and, in order to keep it, in general, as pure as possible, there ought not to be too many worms in a single room—their perspiration being very great, and, consequently, the medium in which they live, is soon affected by this cause. According to their numbers, there ought to be two or more rooms. An eastern exposure is the most eligible, and a northern is less proper, on account of the cold.

b. Respecting the beginning of the culture, or the time at which the egg is taken from the cool place, where it was kept, and brought, for its development, into the room allotted for that purpose, the rule is, that the leaves of the mulberry tree must have just put out; for the first leaves are, if we may be permitted to say so, the milk of the forthcoming worm. The temperature must have risen to 14 degrees (63° 5 Fahr.) Therefore, in Munich, for example, the proper epoch is at the end of May. The worms then come forth in the first days of June. The calculation may be extended to the several districts of the realm, upon a comparison of their mean temperature with that of Munich. In Regensburg, for instance, the process will begin from eight to ten days, and at Wurtzburg and on the banks of the Rhine, from fourteen to eighteen days earlier than at Munich.*

c. The further preparations consist in placing a stove in the room destined for the worms: it ought not to be of iron. We had, however, none of any kind in the room of the Agricultural Society. If there be a fire place, it would be well to burn in it small pieces of wood, by which the air will be purified; and the advantage of a chimney is, that it can be resorted to whenever you wish. It can, therefore, be considered as a substitute for the stove; but, in neither of them, ought oak, nor turf, to be burned. It is advisable to have a thermometer to regulate the temperature.

Sudden changes of the temperature always injure the worms; but they suffer less when the mercury falls one or two degrees, than when it rises high. Generally speaking, the cold is not hurtful to the worms, but it delays their development. Yet the cold acts injuriously upon them when they are near or in their sleep, or when they approach their maturity, or have already attained it; because it then destroys the silk substance enclosed in their delicate vessels. The proper heat exercises a great influence upon the fineness and quality of the silk. If a too high temperature cannot be avoided, no fear need be entertained, if there be a free circulation of the air, by means of the air-holes, as well as of the doors and windows. But, if the interior air is too stagnant, it can be renovated by lighting a little fire in the chimney. The country people, who rear silk-worms

* Mr. de Turk assigns, perhaps, the proper moment rather too early, in fixing it for Prussia, at the middle of May. His memoir contains, nevertheless, many useful details. Another little work entitled "*The Culture of Silk*," by George Lilla: Nordhausen, near Landgraf, 1826, is rather too summary, and will afford little instruction to the practical rearer of silk-worms.

in Italy and France, always keep a thermometer in the rooms where they have the worms, on purpose to observe the changes of the temperature, and to regulate it. Such an instrument costs not more than 20 or 30 kr. It will be well to have two thermometers, and to place the one within the room, and the other without, to ascertain exactly the difference of the two temperatures. An instrument, invented by Mr. Bellani, of Como, called a *thermometrograph*, deserves to be be particularly recommended to silk cultivators, because it indicates the maximum and minimum of the temperature of the rooms, where the worms are reared, whilst the rearer is absent. The following design, in which the instrument is drawn in proportion of half its real dimensions, will give a precise idea of it:

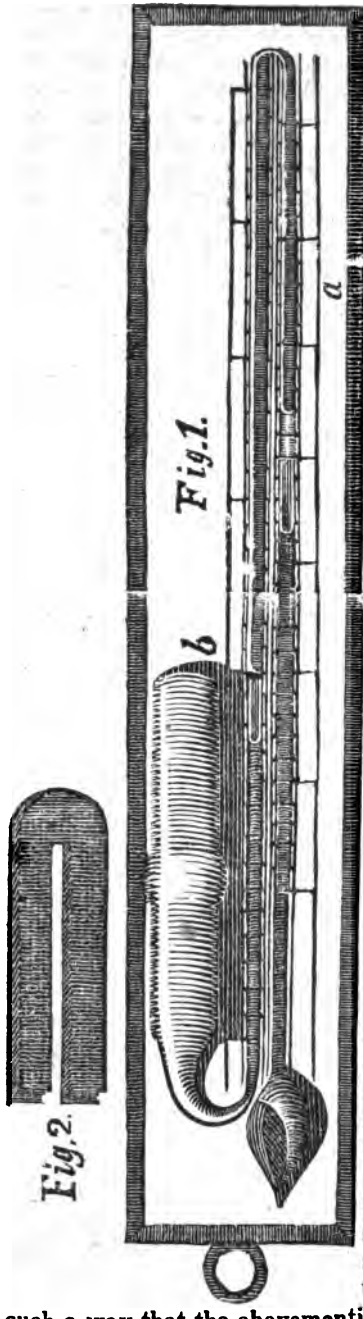


Fig. 1.

Fig. 2.

A glass tube, the diameter of which is thrice as great as that of ordinary thermometers, and the length of which is regulated upon the number of degrees of temperature which it might be necessary to ascertain, is fixed on a varnished board. The tube is, in the middle, curved, so as to form two parallel branches, one of which terminates in a long, vertical, and hermetrically closed ball; and the other in a cylindric vessel, the diameter of which is equal to that of the ball, and the length of which is about ¼ of the tube's whole length. Nearly half of the branch is filled with mercury, and in the upper part is alcohol, in sufficient quantity to fill the rest of the tube and the cylindric vessel, but not the ball, which remains empty, in moderate degrees of heat. In each of the branches, lies, upon the quicksilver, another much smaller tube, nearly half an inch in length, the upper part of which is closed, by means of a soldering pipe, and the other with a disc of black enamel. In this small tube is enclosed a needle of steel, and, at one of the extremities of the tube, is attached a single hair, either of man or horse, which is stretched out the whole length of the tube. In this manner, the internal tubes, which contain the steel needles, can be raised, without obstruction, by the mercury, and remain, by means of the elasticity of the hair, suspended at the side of the external tube, when the mercury falls. The inferior extremity of the needle, shows the degree of the temperature, or the point whither the quicksilver has pushed it.

To make the division, it is sufficient to put, successively, the cylindric vessel, filled with alcohol, in pounded ice, and in boiling water; and to try it, the needles must be brought to fall in such a way that the abovementioned disc should come to lie upon the mercury. A magnet should be used for this purpose, of the form of a

horse shoe, as in fig. 2; the poles must be channelled out, so as to embrace the external tube.

The scale of division is engraved on both sides of the board, but in an opposite direction, and after the following manner:

Mark on the left side, A, 10 degrees of cold, between the point determined by the melted ice, and the inferior bent of the tube; and from the point zero, which indicates the point of congelation, the distribution of the degrees of heat is continued until the 35th degree. On the right side, B, you make the division in an opposite direction; because, the quicksilver, falling in the left branch to the point of congelation, rises in the right branch of the tube, to the height marked zero, and, above this point, are marked the degrees of cold, and, below, the degrees of heat. Thus, the mercury cannot fall one degree, in one part of the tube, without rising one degree in the other, and vice versâ. The needles remaining at the most elevated point where they have been driven, indicate, the one the maximum of heat, and the other the maximum of cold.

In transporting this instrument from one place to another, care ought to be taken to keep it in a vertical position, to prevent the mercury from mixing with the alcohol.

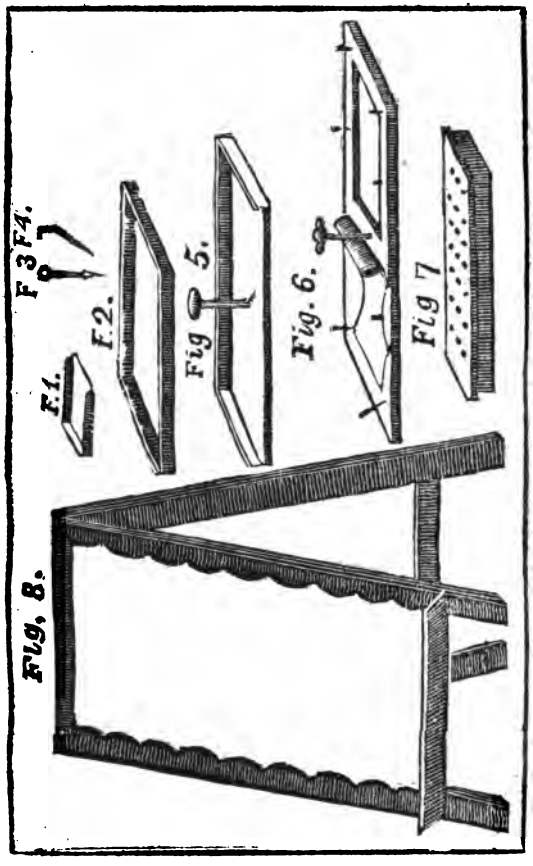
It will also be advantageous to have a hygrometer in the room; an instrument which costs but a trifle. The best are made of catgut. If the humidity exceeds 65 degrees, the atmosphere becomes very injurious to the worms. In default of a hygrometer, you may keep in an earthen plate, upon the table, some common salt, which, by becoming moist, indicates the same hurtful state of the atmosphere. Long experience shows that nothing is so dangerous for the worms as an excessive heat, or an excessive humidity.

In the middle of the room should be a table, upon which you lay the paper with the eggs: There are two methods of promoting the coupling of the caterpillars: either by extending them on a linen cloth, or on sheets of paper, as we shall hereafter describe at greater length. In the former case, the removal of the eggs requires some attention, which Bonafous describes as follows. You carry the linen cloth, with the eggs, into a room, the temperature of which is equal to that of the place where the eggs had been kept during the Winter; the cloth is put in a tub of water, for five or six minutes, and is afterwards left dripping in the hands, two or three minutes. After this, it is laid upon a table, and the eggs are detached with a fine scraper or a quill. The eggs are put again in a water vessel, and softly rubbed with the hand. The water with the eggs, is afterwards thrown upon a sieve, or a linen, to let off the water. The eggs are then removed, and are put, with those that have remained at the bottom of the tub, in a basin; fresh water, and light red or white wine, are thrown upon them. The eggs are then to be gently washed anew, and, the water being let off, they are extended upon a dry and clean cloth, and, when they are quite dry, they are put upon a plate, or upon hurdles, to hatch. This, however, as I have already said, is not necessary, especially if the eggs lie upon paper; each sheet is put in a

larger one of paste-board or a thick paper, all the edges of which are turned up two or three inches, and which repose on a stand of laths, in order that the heat might act, from beneath, upon the eggs; and they are then left in an exposure to the sun, but out of its direct rays. On the first day, the heat ought to be 14° (63° 5 Fahr.) You can also raise frames, fitted up with strong linen, and which are laid upon a small stand.

From the time that the worms change their first skin, until the moment that they begin to spin their silk, canes, placed close together, would be of great use. They are not expensive: for all that is required, are canes, or reeds, and packthread. They last several years, and can be preserved, rolled together, without occupying much space. They agree well with the worms, which thus enjoy the air from above and from beneath. But even this cheap apparatus can be dispensed with. The culture of silk has been carried on, at first, by the Agricultural Society, by Mr. Wurz, and by some other individuals, by means of ordinary sheets of paper, which were afterwards put, together with the worms, upon shelves, where books or documents had before been lying; and when the worms grew larger, in the process of time, and accordingly required more space, more paper sheets were put.

Although these preparatory measures have proved sufficient, in the experiments tried by the Agricultural Society, as well as in those instituted by Mr. Wurz, it may, however, not be useless to mention some of the instruments recommended by Mr. Bonafous, for a culture upon a great scale. The designs of some of them are given; the others will be understood from description.



a. The *Scraper* : an instrument much like the one which serves for scraping the dough from the brake. It serves for detaching the eggs from the wet linen cloth ; but the edge of the blade must be neither too sharp nor too blunt. (fig. 1.)

b. Bandboxes for the hatching of the eggs.—The smaller ones are made of pasteboard, and the larger ones of thin board. Five square inches, at least, must be reckoned for an ounce of eggs. The boxes must be lined with paper ; and, on the sides, the weight of the eggs should be marked, that it may always be exactly known how many eggs each box contains. (fig. 2.)

c. A Tin Spoon, nearly of the form of a spatula. It serves for stirring the eggs, when the worms are near being hatched.

f. A Prick Punch.—This tool is made in such a way, that, upon the first stroke of the hammer, the paper is instantly perforated in several places. The holes must be sufficiently great to leave a passage to the worm, when it is just hatched ; and, as soon as the worms are in life, these papers serve to separate the shells, and to take them from the

boxes. To render this easier, four cords are fixed crossways on their edges, and are, at proper distance, bound up in a knot, in form of a small hook. This instrument is a crooked iron, by means of which, you may easily lift from the bandboxes, the smaller branches, covered with worms, and lay them upon the hurdles: for, in touching them with the hand, these delicate little insects might be injured. (fig. 4.)

f. The Hurdles.—They are put against the wall, at a distance of about one inch, and upon a stand. Their breadth should generally be from 30 to 32 inches, and their length from 9 to 12 feet. They are put above one another, 22 inches asunder. The hurdles are edged by laths, four inches long, which serve to support the small portable trays. The canes, of the hurdles' bottom, are an inch distant from one another, and are fastened with twine to the cross-wood. They may, also, be made of any branches or brush-wood. The canes must be somewhat asunder, to let the air be in contact with the paper, with which the hurdles are covered, and to dry it the quicker.

g. Small portable Trays.—These are, thin boards from 12 to 14 inches in width, and sufficiently long to fit across the breadth of the hurdles. A handle is fixed in the centre; and the trays must be very smoothly finished, that the worms may lie upon them without difficulty. They have then their side ledges about half an inch deep.—(fig. 5.)

h. Travelling Case.—This is very convenient for transporting the insects about. It is like a medal box.

i. Knife, to cut the leaf small.—It must be kept clean, and never be used for any other purpose.

k. Double Chopper.—It has two parallel edges, and is much like an ordinary kitchen chopper; it is used after the leaf has been cut with the knife.

l. Large chopper, which is made somewhat like a straw cutter. A great quantity of leaves, can be cut with it in a short time. It is therefore very useful for the silk culture, on a large scale.

m. A Spatula of metal, which is turned up at three sides—It serves to clean the papers of the hurdles, principally when the worms are in their last ages.

n. Square Baskets.—They should be very wide, and shallow, with a hook fixed to the handle, that they might be easily hung on the edge of the hurdle. They must be kept very clean. From these baskets the leaves are distributed to the worms.

o. Small hand Birch Broom.—It serves to spread the leaves evenly upon the hurdles.

p. Frames for placing the worms upon.—They are covered with linen, which may be changed when dirty. The handle facilitates the transporting them. (fig. 6.)

q. Boxes for keeping the moths in.—They have air holes in the sides, and serve to keep the moths from light, without injuring them, and to prevent the males from flapping their wings. (fig. 7.)

r. Stand.—It shuts up, and takes up no room. The linen is spread on it, upon which the eggs are gathered. (fig. 8.)

s. Frame.—This is a small frame, provided with thread. The

linen cloth, containing the eggs, is stretched out upon it, and they thus remain, on all sides, in contact with the air, and keep fresh and dry.

§ 61.

1.—The coming forth of the moth offers the following particulars. In Italy and in the South of France, young girls carry the eggs in their bosoms, and hatch them by their natural heat. In other countries, this is done by means of manure, or hot-houses. But it is proved, that a too sudden and too great heat, is rather noxious than useful; and it is better to leave time for the eggs to be hatched gradually.

Bonafous rates the period of hatching from 10 to 20 days only, and requires for the first two days, 14° (63° 5 *) for the third, 15° (65° 8;) the 4th, 16° (68° 0;) the 5th, 17° (70° 3;) the 6th, 18° (72° 5;) the 7th, 19° (74° 7;) the 8th, 20° (77° 0;) the 9th, 21° (79° 2;) the 10th, 11th, and 12th, 22° (81° 5.) † He recommends to stir the eggs, in this interval of time, once or twice every day. When they begin to assume a whitish color, it is a sign that the worm is formed. It will then be proper for the eggs to be covered with a veil, or with paper, and to spread around leaves or small branches of mulberry. Most of the worms will come forth in the morning.

If the air be too warm or too dry, a basin or two of water may be placed upon the table, whereby the air will be improved, and the hatching promoted. Experience shews, besides, says Bonafous, that those worms which come forth in the last days, are the strongest and healthiest, and he accordingly advises to destroy the earliest; to have them of the same age and size, the first hatched should be fed less, and the younger and later ones somewhat more. The old ought to be kept separate from the young, in order that, afterwards, all the worms may be fed to the same degree. Their health may be known by their color, which must be neither red nor black, but dark chesnut.

It ought not to be neglected to have eggs in reserve, or kept in a cool place, that, if, by accident, the hatched eggs should be damaged, or a sudden frost should spoil the leaves of the mulberry tree, whereby the worms would remain without food and perish, a new trial might be instituted with the eggs that had been preserved.

§ 62.

2. *The Silk-Worms during the first age, till their first moulting.*

This is the first period, and like the childhood of man. Every

* Fahrenheit.

† I have just read in French newspapers, Mr. Bonafous' report on his culture of silk, during the year 1825, on his estate near Turin. He had prepared for hatching three ounces of eggs, on the 30th of April, which, is for Italy, the proper epoch. The hatching lasted eleven days, by a temperature from 14 to 20 degrees, (from 63° 5 to 77°) until all the worms were hatched. The first age of the worms took 5 days; the 2d four; the 3d seven; the 4th seven, and the 5th six; or twenty-nine days in the whole. The completing of the cocoons required seven days more. He thus obtained very beautiful cocoons, and altogether a very rich crop.

thing depends then on the nourishment, and the manner of tending the worms. It is now exactly known, from long experience, what quantity of food the worms require in their several ages, until they have begun to spin their silk. A French ounce being equal to 1¼ ounce of Bavaria, we may, on an average, set down half of the quantities which Mr. Bonafous indicates; and twenty thousand worms correspond to one ounce of eggs of our weight, and they require, through all their ages, a thousand pounds of leaves. From eighteen to twenty good mulberry trees give, each, one quintal and a half of leaves, and, consequently, from eight to ten trees are necessary for twenty thousand worms. Every silk-worm rearer can thus calculate, proportionally, the number of eggs and trees. In regard to the feeding, during the several ages, it is to be observed, that the worms require, in the first age, a hundred and twelve times, in the second age, 336 times, in the 3d age, 1,120 times, in the 4th, 3,360 times, and in the 5th, 20,296 times as much as they weigh in the form of eggs.

On an average, twenty thousand worms require,

In the first period,	-	5 lb. of leaves,
2d	-	15
3d	-	46
4th	-	139
5th	-	795
		lbs. 1000

Until lately, twice as much would have been consumed in Germany, in consequence of the many errors which attended the rearing of the worms, their feeding, the economy of the leaves, &c. &c.

During the two first ages, the leaves should be cut very small, either with the ordinary chopper, or with a straw-cutter. The branches and buds ought to be previously separated, so that nothing but the tender leaf may be given to the worms. The leaves must be cut in the third, fourth, and fifth ages, but not so fine. Yet, as has already been repeatedly observed, they must be clean and sound, which will be known from the fresh green color they have when they are so. It will be well, principally in the two first ages, to keep the leaves in a cool place, such as a cellar, that they may remain fresh, and sheltered against the air and the sun.

It must further be observed, that, in the two first ages, the worms should be fed upon such leaves only as have been gathered seven or eight hours previously; but, in the later ages, they ought to have been pulled one or two days before. *In Germany however, the fresh leaves are preferred at all times, and, perhaps, erroneously.

* There may be, by chance, a deficiency of leaves, even at the beginning and during the life of the worms, and it may therefore be advisable to devise a means of supplying their place, and to save the worms from dying, before the new leaf has appeared. Bonafous and Dandolo may be right to think that there is no other food for the silk-worm than the mulberry leaf. It may nevertheless not be useless to mention here, the experiments that have been instituted to discover a substitute, were it but to encourage further trials. Mr. Seitz has made experiments, of which he has given an account in the *Weekly paper of the Agricultural Society of Bavaria*: *Year* XV. *p.* 318; and

The leaves ought to be cut shortly before they are to be eaten The best method is to let the worms have four meals within 24 hours: the first at 4 o'clock, the second at 10 o'clock, the third at 4 o'clock at night. It was assuredly a great mistake to give the worms two meals only, one in the morning, and the other in the evening, as if the worms passed the night in their beds, like human creatures. On distributing the new meal, the leaves of the previous one must be eaten up, and an hour and a half must have elapsed in the interval. The temperature of the room should be maintained at 19° (74°7) in the 1st age; at 18° or 19° (72° or 74° 7) in the second; at 17° or 18° (70° 3 or 72° 5) in the third; at 16° or 17° (68° or 70° 3) in the fourth; at 16° or 16° 5 (68° or 69° 1) in the fifth age; and at 16° 5 or 15° 5 (69° 1 or 66° 9) towards the latter part of the rearing.

he observes: "It appears from these experiments and trials, that it is not easy to find a substitute for the leaves of the white mulberry tree, so much the less, as, even among the different species of mulberry trees, the white affords the best nourishment, and the worms fed upon its leaves, produce the best silk. The gummy mucilage, which is peculiar to the mulberry tree, is perhaps the prime matter—the generative element—of the silk, which the caterpillar, during its life, absorbs along with the other nutritious substances, filters and transforms into silk."

Mr. Burgsdorf maintains, nevertheless, that the leaves of Linnæus' *Acetatoricum* are much relished by the silk-worms; and some other persons think that old or dry leaves can be substituted in place of the fresh, and that there should, accordingly, be made a provision of them. The worms may, indeed, feed upon them, in the latest period of their lives, if, before they are distributed to them, they are moistened and dried anew; because the worms are then very hungry and not so delicate in the choice of their food: but they will hardly be satisfied with them in their earlier state. Not long ago, the Countess Eleonora della Porta, of Hiezing, near Vienna, obtained from the Emperor of Austria, a patent for feeding the silk-worms with dried leaves, to preserve them against the dangers of a total want of food, in consequence of late frosts.

A few weeks since, a gentleman from Sweden, assured me that last year the leaves of the white raspberry bush (*Rubus idæus spinosus, fructu albo*) had been employed, with success, for the feeding of silk-worms, in that country, and had consequently proved a good substitute for mulberry leaves.

It is a striking fact, that, two years past, Mr. de Schrank had already observed to me, that, according to his experience, such a substitute must exist. He had, in 1780, some worms, but wanting food, and being much distressed for the worms, he put them in his little garden, thinking that they would, perhaps, find themselves means of escaping death. A few months afterwards, he found several cocoons on the gate of the garden. Notwithstanding his extensive knowledge in botany, he could not discover on what species of leaves the worms had fed.

Still more striking is the following information, which Mr. Reichhold, a civil officer in the Grand Duke's service, addressed to the Board, on the 19th of April, 1826. "In regard to my former experiments, I will say that, after having failed with the silk moths, I did not care much for the eggs, and I left them in a place where they were exposed, during the whole Winter, to the greatest cold. When I found them again, in the Spring, I thought that they must be frozen; I carried them, nevertheless, into a room, where the worms were hatched shortly afterwards, and were as lively as if they had endured only a moderate cold. But it was too early for the season: for the leaf of the mulberry had not yet made its appearance. By way of experiment, I fed the little worms till their first moulting, upon the tender yellow leaves of the headed lettuce: after this, I gave them mulberry leaves, and reared them thus till they began to spin their silk. They declined a little, but none died. I had besides only one large black mulberry tree. Nevertheless, two-thirds of my cocoons were beautiful, white, and close, and one third of a brimstone color."

In the environs of Lyons, also, silk-worms have been fed with good success, till their second moulting, upon lettuce. See *Compte rendu des travaux de la Société d'Agriculture de Lyon*, 1820, p 148.

In regard to the space which the supposed number of worms (20,000) requires in the several ages, and in proportion of which the boxes must be enlarged or multiplied, it is to be observed, that 20,000 worms require, on an average, in the first age, five feet square; in the second, ten feet; in the third, twenty-three feet; in the fourth, fifty-five feet; and in the fifth, one hundred and twenty feet square. Upon these general rules, the following will be each day's task, in regard as well as to the feeding, as to the tending of the worms:

First day.—The four meals require together thirteen ounces* of leaves, which are distributed in increasing proportions. It is advisable to give small portions of food, in the intervals of the regular meals, without exceeding, however, the quantity fixed for the whole day. Generally, the worms eat each of their meals in an hour and a half; and they remain afterwards quiet, but they may receive, at intervals, the little supplementary food we have mentioned above. The space must be enlarged on each distribution, and the worms can be laid with a quill in their right place.

Second day.—The four meals require nineteen ounces. The rule of giving, at first, small portions, and, at last, the largest, continues to be observed, as on the preceding day.

Third day.—One pound and ten ounces of leaf. The appetite of the worms increases, and the intermediate portions ought not to be neglected. The space must be enlarged, by the addition of nearly one-third of what it was at the beginning.

Fourth day.—Nineteen ounces of leaf are necessary. The first meal must be the most copious, and the following must decrease in quantity. The worms must be at their ease, in regard to space, so as not to be one upon another, especially when the torpor approaches, which begins at the end of the fourth day.

Fifth day.—Six ounces of leaf are distributed to the worms that are yet awake. Should this quantity not be sufficient, it may be increased. But, in the evening, all the worms will be asleep, except perhaps some who have already awoke.

There yet remain, therefore, of the five pounds of food fixed for the first age, one pound and twenty-nine ounces, part of which will be lost by carrying about the leaves, and the rest will be consumed by the worms in the intermediate time of the regular meals.

The windows ought to remain shut during the worms' first age, but the doors may be opened to keep up the required temperature, and to purify the atmosphere of the room.

Method of purifying the air.

The country people in Italy and in France, use, for this end, a very simple means; by garnishing, from time to time, their windows with wormwood bushes. In Germany, and especially in Prussia, a little

* The Bavarian pound is divided in 32 *loths* or ounces.

saltpetre is burnt on an earthern plate, in the laboratory. The ordinary fumigations which are sometimes resorted to, are rather hurtful than beneficial; and all these methods should alike be abandoned.

But the purpose for which they have been employed, deserves great attention; for a pure and wholesome atmosphere is the more indispensable for the worms, as they respire through the air holes, which are in several parts of their bodies, and many unhealthy exhalations arise from the litter with which they are in constant contact. According to Bonafous, the gas of the oxigenated muriatic acid (*acidum muriaticum oxigenatum*) is the most proper means to purify the air, by destroying the offensive effluvia, and to desicate matters which are near a state of fermentation. This remedy is not very expensive. Take seven ounces of common salt, and three ounces of black oxyde of manganese; put this mixture in a bottle, with two ounces of water, cork it well, and keep it far from the stove and the fire-place of your laboratory. In a smaller bottle put two pounds of sulphuric acid, (oil of vitriol.) The manner of proceeding, is to take from the second bottle a wine-glassful, or two-thirds of a spoonful of oil of vitriol, and to pour it into the large bottle. A white vapor will immediately arise, and, in carrying the bottle through the laboratory, you spread the vapor through the whole air. When the vapor ceases, the bottle must be corked, and put in its usual place. The prescribed remedy should be resorted to, whenever, on entering the room, any closeness is observed in the air, or there is a difficulty of breathing. Even should there be no perceptible difference between the interior and exterior air, during the fifth age of the worms, it is good to repeat this fumigation three or four times a-day. If you put in the bottle, instead of manganese, or the common salt, nitrate of potash, (common nitre,) and pour upon it the oil of vitriol, as described above, it will produce nearly as good an effect. The gas produced by this last composition, is less subtle, and not so dangerous for the respiration. Should the substances in the bottle harden, a little water may be added, and the whole stirred with a stick. This remedy secures the following three great advantages to the worms: 1st. The vapor in spreading, immediately destroys any unpleasant effluvia. 2d. It diminishes the fermentation of the litter, and dries it up. 3d. It neutralizes the effect of all the deleterious exhalations, which might injure the health of the worms. Lastly, it improves the quality of the cocoons.

Bonafous refers also to the method proposed by Count Chaptal, which I have tried with success, on purpose to prevent the effects of humidity, and of animal exhalations. It only requires a little quick lime on plates, which are placed at some distance above the floor: the quick lime soon slacks, while it absorbs the moisture and the carbonic acid gas.

Should you prefer to burn vegetable substances in your close laboratory, you ought to consider that this fumigation will not only produce a consumption of vital air, but occasion a multiplication of gases most offensive to respiration. Vinegar, poured upon hot surfaces,

is decomposed, and produces also a mephitic gas. Both methods should therefore be abandoned. A fire in the chimney may be preferable. But the best means of keeping the interior air in a healthy condition, is an extreme cleanliness. All smoke is noxious and may, on many occasions, suffocate the worms, chiefly if the laboratory be humid. Many unfortunate instances may be adduced, as proofs of this danger.

Formerly the interior air of closed rooms was purified;

1. After Guyton-Morveau's method, by the vapor of a mixture of common salt, black oxyde of manganese, and oil of vitriol;

2. After Carmichael Smith's method, by producing nitrous vapors from a mixture of nitrate of potash, and of oil of vitriol;

3d. And by a mixture of sugar of lead, and of oil of vitriol.

The first two methods have several inconveniences; for the gas is impure, hurtful to respiration, occasions coughs, oppressions, &c. &c.; it injures the polish of the house furniture and of metals, the carpets, pictures; and the vitriolic gas injures even the irons upon the doors and the windows.

Oil of vitriol requires, besides, great caution; and sugar of lead cannot be trusted to everybody.

The third method of fumigation is still less apt to improve the air.

The Apothecary Chevalier de Stahl, of Augsburg, has invented another remedy, free from all the abovementioned inconveniences, and by which pure chlorite gas can be produced. This well-tried remedy, which is, also, an excellent medicine in many diseases, consists of Oxymuriatica calcaria, and sulphas potassæ acidulus.

These two powders are put separately in two well corked phials, in a place well protected from humidity and light, as for instance in a box, and when the remedy is to be applied, one or two spoonfuls (according to the size of the laboratory) of each of the said powders are thrown in a saucer, or on a wooden trencher, by means of a small wooden or glass stick, and turned into a paste, with a little water; from this result, by affinities, new bodies, from which the chlorite gas escapes.

It is unnecessary to say that, during the fumigation, the doors and windows must be kept shut; but it may be observed, that, if the vapor from the abovementioned mixture should disappear too rapidly, a little more powder should be thrown from each of the phials, and half an hour, or an hour after the fumigation, the windows may, for a while, be opened.

The fumigation by means of minerals, surpasses all those that were formerly known, as the apothecary Mr. Lesmuller is able to prove. Detailed facts may be found, with regard to this, in a publication entitled "*Dr. Wetzler, On the utility and use of the Oxymuriatic gas, as a remedy and means of purifying the air.*"—Augsburg, 1825. One only of these remedies ought to be employed.

According to the facts above stated in regard to the feeding and tending, the first period or first age of the worms, lasts five days. But, according to the regulations mentioned, as more generally ob-

served in Germany, that age should last six days. But two meals only are then given in 24 hours, and this retards the growth of the worms, and their moulting, or the passage to the second age. During the moulting, fresh and healthy air is necessary, and contributes much to accelerate their growth.

§ 63.

3. *Rearing of the Worms in the second age.*

Before distributing the first meal, it should be ascertained whether all the worms are fully awake. They are then not very hungry, and they want free air, and a gentle heat, more than food. The moulting takes place, generally, in one day; whilst in the German method, two, three, and even four days are required, which, as has already been said, arises from the want of a proper regulation in the meals.

The difficulty in the casting often arises also from the efforts of the worms. For, as soon as they approach the moulting, and the first skin becomes too tight, from its not having extended in exact proportion with the growth of the body, the insect strives to throw it off: nature, besides, has already provided it with a new and finer envelope, and has endowed it with means of making the change. To this end, it eats much thirty or thirty-six hours before the body swells, and the strength of the insect is increased. Shortly before the casting, it ceases to eat, it cleans itself, and thereby becomes reduced in size. At the same time, it fastens the old skin with threads of its own spinning, to the twigs, to the hurdles, or the paper, moves about, and turns upwards with the head, until it issues or escapes from that skin. Often it remains in the meanwhile quiet, and seems in a state of torpor. During this whole process, which is a sort of crisis, it must not be disturbed: for it would otherwise be compelled to spin new threads, and to exaust its strength in that operation.

First day.—This day, one pound and four ounces of branches are necessary, and as much fine chopped leaf, or two pounds eight ounces of the leaf alone. In the moment that all the worms are revived, and turn up their heads, the cleaning must begin, and the worms must be put on other paper. Those that are not yet awake, may be left where they are. The branches, and three or four leaves, serve the best for the removing, and, at the same time, for the first feeding. The enlivened worms will gather upon them, and may, in this way, be deposited on a new paper. The others are to be left undisturbed, until they have accomplished their casting. Feeble worms, which are unable to effect it, must be separated, and removed into another room, or cast away. One or two hours after, they are revived on a new bed; they are then covered with leaves; and, on that day, they need only two meals. The old papers are, in the meanwhile, cleaned out of the laboratory, and laid aside for future use.

Excremental matter of the worms.—The evacuation consists in a solid substance, under the form of little black globules, which should

be collected in a separate vessel. It is the best manure for hot house and for flower beds, and furnishes, also, a green color. The boxes can be cleaned with a little broom; but it will better to change them.

Second day.—Four meals are given, which require three pounds and three ounces of leaf. The first meals are less copious than the succeeding, and the space for the worms is gradually enlarged.

Third day.—The worms require three and three-quarters pounds of leaf; the first meals must be the most plentiful: for the appetite of the worms diminishes again towards evening, with the beginning of the second moulting. The space must, also, be enlarged.

Fourth day.—two pounds and six ounces of leaf will be sufficient on that day; but the distribution should be regulated according to the exigencies of the worms. If the weather is not cold and windy, the windows may be opened; but the temperature must not be lowered more than one degree, and then the windows must be closed again. The sleep of the worms being promoted by a new and healthy air, they will all soon be in torpor.

Rating at three pounds six ounces, the expense of leaf for the intermediate meals, and some accidental loss, the whole consumption for the second age, will amount to fifteen pounds.

§ 64.

4. *The Worms in their Third Age.*

First day.—Two pounds and twenty-eight ounces of food are required for this day, partly in small shoots, partly in finely chopped leaves. The more coarsely chopped leaf, can only be given at the close of the age. The surest sign that the worms are revived, is an undulating motion which they make with their heads, when horizontally blown upon. The shoots serve for the cleaning, as on the first day of the preceding age. Two more meals are distributed. The worms that have not accomplished the second age, must be placed separate in a warmer part of the laboratory, and they will then soon be equal to the others.

Second day.—This day ten and three-quarter pounds of leaves will be needed; and the first meals must be the least copious.

Third day.—Eleven and a quarter pounds of leaves should be given. The two first meals should be the most plentiful. Their change approaches.

Fourth day.—Six and a half pounds of chopped leaves will be sufficient. The first meal should be the largest. The worms that are not yet torpid, are fed alone, and often.

Fifth day.—Three and a quarter pounds of leaves must be kept in readiness, and distributed to the worms that are yet awake. This day, the temperature of the laboratory should be kept unvaried; and therefore the windows must remain shut, whilst in the preceding day they might have been opened, to improve the interior air.

Sixth day.—As the worms begin to awake on this day, little food will be necessary.

There are yet remaining 11 pounds 20 ounces of leaf, which may be employed in the way already explained; and the whole quantity consumed will amount to 46 pounds.

§ 65.

5. *Rearing of the Silk-worm in the Fourth Age.*

First day.—On this day, four pounds and a half of the young shoots, and seven pounds four ounces of coarsely chopped leaves, will be needed. The space must be enlarged, and the cleaning should be well attended to.

Second day.—For this day will be required twenty pounds of leaves, coarsely cut. The two first meals should be the lightest, and the two last the most copious.

Third day.—For this day will be needed twenty-six pounds of leaves, slightly cut. The last meal should be the most plentiful.

Fourth day.—This day thirty pounds of food will be needed; but the leaves are not to be chopped. The last meal must be of six pounds.

Fifth day.—Fifteen pounds of leaves will be wanted. The first meal should be the most considerable. A great number of the worms become torpid on this day.

Sixth day.—Three pounds and a half will be distributed, in a quantity proportioned to the wants of the worms that are awake.

Seventh day.—Most of the worms rouse on this day. In the period now elapsed, the windows and the doors should have been frequently opened, to renew the air of the room, because the steamy vapor, which the worms discharge, begins to be perceptible.

The total amount of the food for the fourth age, being 139 pounds, it results, from the preceding statement, that 32 pounds and 28 ounces remain for intermediate distributions, &c. as explained above.

§ 66.

6. *Of the rearing of the Silk-worms during the Fifth Age, until the completion of the cocoon.*

First day.—This day almost all the worms must be revived. The space where they are, should be cleaned, and widened; ten pounds and a half of young shoots, and the same quantity of leaf, will be needed. The door and windows should be opened, and the interior air of the laboratory should be frequently renewed. One of the meals may consist of young shoots, and the two others of leaves.

Second day.—For this day will be wanted thirty-two pounds and three-fourths of leaves for the four meals: the first should be the least, and the last the most copious.

Third day.—This day forty-six pounds and a half will be needed. The first feed again is the less, and the last the most plentiful, and, as has already been said, the leaves must no longer be chopped.

Fourth day.—This day the worms will require 65 pounds 4 ounces of sorted leaves. The first feed should be of 13 pounds 28 ounces, and the last of 18¾ pounds.

Fifth day.—The worms will, this day, want 92¾ pounds. The first feed should be of 18¾ pounds, and the last of 23½ pounds. If necessary, the worms should have some intermediate food. The cleaning must take place towards evening, and the interior air must be frequently renewed, as on all such occasions. The doors and windows can even be left open, if the weather is not windy and rainy.

Sixth day.—The worms should have 111½ pounds of leaves. The first feed should be the most plentiful. If the quantity distributed has been devoured in an hour, an intermediate meal should be added. The beds of the worms should be widened.

Seventh day.—The worms will require this day 107¾ pounds of leaves. The first feed should be the largest, and intermediate meals be given, as before. The worms approach now to maturity, as will be more largely explained in § 68. The refreshing of the interior atmosphere should not be omitted.

Eighth day.—The worms, this day, must have 75 pounds of leaves. The first meal should be the largest, and of 23 pounds, and the last should be the least plentiful. Some intermediate food should be given. During the last days of the rearing of the worms, they should be fed with the best sort of leaves, always culled from the oldest trees. The cleaning and the purifying of the air should be carefully attended to. These attentions are now more essential than on any former occasion.

Ninth day.—The worms, this day, need 60 pounds 14 ounces of leaves, which must be distributed as they may be wanted; the worms approach their maturity, and begin to eat with less voracity. The air must frequently be renewed, and the proper temperature should be preserved. The windows should, nevertheless, be opened, at intervals, that the interior atmosphere may be entirely changed.

Tenth day.—Twenty-eight pounds and four ounces of leaves will be sufficient, but more may be allowed, if necessary.

Eleventh day.—The worms are already engaged in weaving their cocoons. Those that shew some appetite, and have not commenced their work, must, of course, receive a little food.

From the 795 pounds fixed for the fifth age, 154 pounds 18 ounces remain for accidental losses, and the intermediate meals.

It must yet be observed, that the maturity of the worms follows this daily progress only when the prescribed attentions, in regard to the feeding and the temperature, are strictly observed; otherwise, their growth is slower. Hence, Mr. Nagel, who recommends two feeds only in twenty-four hours, fixes the first, second, third, and fourth ages at six days each, and the fifth at nine days, and he reckons for the moulting, two, three, and four days; whereby the life of the worms would last forty-three days, whilst, after Bonafous' method, it lasts thirty-two only.* The end is obtained in this latter method,

* In Mr. Turk's Essay on the Culture of Silk, (Potsdam, 1825,) which has just come to my knowledge, thirty-six days are mentioned. Among the Bavarian cultivators, there are examples of forty, forty-four, and forty-seven days.

as in the others, but with more slowness; and the silk-rearer must make his calculations upon that difference.

The table at the end of the present volume, will afford a summary and comprehensive view of the progressive rearing of the worms.

§ 67.

7. A species of Silk-Worm of a dark grey color, with singular marks.

I speak of this species only to refute the error that they are not real silk-worms, or that they make a different sort of cocoons. But they need not be separated from the other species: for the cocoons will be exactly the same.

§ 68.

8. *The Cocoons.*

The maturity of the worms, and their capacity of forming the cocoon, are ascertained, when they get upon the leaves, without eating them, rear their necks as if in search of something; and, when looking at them horizontally, or taking them in the hand, against the light, their bodies seem transparent, which gives them the appearance of a yellow plum, or of white and ripened grapes. They give, spontaneously, signs of their maturity, by rearing their necks, by getting upon the edges of their beds, and by endeavoring to move along. The rings draw in, the skin becomes wrinkled, about the neck, and the whole body has more softness to the touch, than heretofore, and feels like soft dough. On the first appearance of these signs, and even in the last days of the fifth age, every thing should be prepared for their rising.

Preparations for the rising of the Silk-Worms.

The boxes in which the worms have been kept, are put on the shelves, which before have served for books or papers, and faggots, or bundles of dry, leafless bush, or brush wood, or common broom, are arranged, so as to end in an arch. The worms climb up, and generally seek to fix themselves on the top branches, where they begin to work their cocoons. Care must be taken to make them this easy, in order that they may not uselessly waste their strength and their silk; and they ought to be assisted in their climbing upon the faggots. Whilst the bundles are placed, the beds of the worms should again be cleaned, and the temperature should be kept at 17° (70° 3, Fahrenheit.) The branches of the faggots must, of course, be in sufficient quantity, and clean, and must not be laid upon the beds of the worms, but spread outside of them, like fans. Worms that are ready to rise, may be taken up and put near the ends of the faggots; but they generally find their own way, and prefer the higher stations for forming the cocoon. It is not necessary to be in a hurry to make

them climb; but care should be taken that the space between the shelves be dry and capacious, so that the worms may work with ease. Experience shows, however, that some worms are so lazy, that they remain immovable thirty-six hours after the others have begun to rise; to encourage them, a box with shavings of timber, should be kept ready, with a few leaves, in which the weak worms are laid; and by a temperature of 18° (72° 5, Fahrenheit,) they will begin their work: the box may be covered with a sheet of paper, picked full of holes. This method has been employed with great success, in the building of the Agricultural Society. At the beginning of the formation of the cocoons, care should be taken to feed the worms, which are yet hungry, upon the best leaves: the cocoons being formed, the beds should be taken away, to be cleaned in another room.

Completion of the Cocoon.

As soon as the worms are seen spinning their silk, the air may be permitted to circulate freely in the laboratory, but the temperature must not be lowered sensibly: the two extremes of heat and cold, are alike injurious to the worms, and ought, therefore, to be carefully avoided. From the moment that the net begins to be visible, the worm works within the cocoon, and completes it in three days and a half; the worm is then transformed into the nymph. On the seventh or eighth day only, the cocoons can be taken from the faggots; this must be executed with much caution. The gathering must be commenced below, and continued upwards, and the soft cocoons must be separated from the hard ones. The floss silk ought also to be collected, and kept separate, as it forms an article of trade. The cocoons diminish always in weight, when they are long kept. They are sorted, according to their colors: the white ones are the most precious; those of a yellow color, vary in the depth of their shades, and some are of a greenish yellow, or like sulphur. In a well-regulated culture, the weight of the cocoons is always in exact proportion to the space which the worms have occupied. 130 cocoons correspond to 239 feet square; and upon this fact, the calculation may be extended.

Management of the Cocoons.

A selection must be made of the cocoons which are destined to serve as seed, and those which are to be sold, and employed in fabrication. If one or more ounces are to be applied for the culture, the seed-cocoons of that weight must be chosen; sixty pair of butterflies are averaged for the ounce, and these give 120 cocoons. The best should, of course, be taken for the seed. They are distinguished by their straw color, by their greater hardness, chiefly at the extremities, and by the superior fineness of their web. Double cocoons should always be excluded. The best, are those that are a little depressed in the middle, as if tightened by a ring, and they are, besides, not the largest. If white silk is desired, the choice must be made among the

white cocoons, exclusively. There are no certain signs to distinguish the cocoons which are to produce the male moth, from those that contain the female; but experience teaches that the cocoon which is smaller, sharper at one or both ends, and depressed in the middle, generally produces a male; and that a round, full cocoon, without much or any depression in the middle, contains the female. The cocoons intended for seed, should be stript of the floss, that the moth may not be embarrassed when it first appears; and the cocoons, thus sorted, should be laid separate. The killing of the chrysalis must be attended to, in regard to the remaining cocoons, to prevent them from being pierced by the moths, whereby the web would be injured, or so much disordered, at least, as to make the silk of the cocoon fit only for floret. The cocoons of the latter description, form a separate branch of trade. Each silk-pod consists of one single thread, the length of which varies from 900 to 1,200 feet. This thread is reeled off, spun, and woven into stuffs; which process, however, more properly belongs to the manufacture, than to the culture of silk.

The killing of the chrysalis is an important task, and must be accomplished with great care, in order that the silk-pods, or cocoons, may not be lost for the trade or manufacture. The three methods of doing this, are: 1st, The one most practised in Italy, and which consists in exposing, during three days, the grubs in the cocoons to the ardent heat of the sun, when the thermometer is at 25° (88° 2 Fahr.) from 10 o'clock, A. M. until 4 o'clock, P. M. 2dly, The one more generally followed in France, and by which, the cocoons are thrown into a bag, and thus put into an oven where bread has just been baked, and the temperature is yet 25° (88° 2 Fahr.) The oven being shut, and the bags frequently stirred, the grubs are killed within four hours. And, 3dly, The process the most proper for Germany, viz: the killing by the steam proceeding from the scalding water, with which a kettle is filled to the two-thirds. The grubs may also be killed by the vapor of sulphur; but this is the least certain method, and does not deserve a more particular mention. The killing must take place within the twelve days that follow the completion of the cocoon; because, on the 12th day, the grub begins to moisten the inner part of its silky habitation, to develop and to prepare itself for piercing it, and to fly, instead of creeping, as it had done before. The soft or weak cocoons must already have been sorted, and should be reeled immediately.

The double cocoons ought also to have been separated, because, to kill them, more time is required than for the single ones. Over a kettle, fixed in the wall, such as are used for washing linen, and filled with boiling water, two pieces of wood are laid across, upon which you put the clean basket, with the cocoons, over which two or three woollen cloths are extended, that the steam may penetrate completely. The fire under the kettle must be kept up, so that the water may continue boiling. Three hours, in such heat, will kill the chrysalis. To ascertain whether this has taken place, one of the cocoons should be

opened. The basket with the killed pods, is then left for a day, untouched, in order that the cocoons that have been softened, might harden again. But, on the next morning, the basket is to be emptied, and the cocoons are deposited in a place whence they may soon be transferred to a purchaser. The method employed with one portion of the cocoons, is to be continued until all the others are likewise killed. It seems that, in some parts of France, a paper, steeped in turpentine oil, is laid betwixt the cocoons, whereby they are killed within twelve hours.

§ 69.

9. *Two open Cocoons, or Cocoons with their grubs. The upper one contains only the shell of a developed chrysalis; but in the lower is seen the immature chrysalis, with the skin of the late moth.*

As this part of the plate does not need any particular description, we may here indulge in some general remarks upon the nature of the silk-worm. Vested, upon its appearance, with a velvet-like skin, it falls, during its short life, into four torpors; and, after having thrown off its old skin, rises from each sleep, under a new form, gradually becoming whiter, smoother, larger, and more beautiful, until at length it is perfectly transparent. Dissatisfied, as it were, with its abode upon the earth, it strives to climb towards Heaven, in search of a more perfect state of existence, and of a more complete metamorphosis than it has previously experienced, and prepares to sail through the airy space, instead of crawling upon the earth. As soon as it has found a place where it can spin its silky bag, it pours two drops of a clear yellow liquor on the spot where it intends to fasten its web. The first web is the net of the abovementioned floss silk, and destined, as it were, for external security. After having accomplished this task, on the first day, it begins to spin, with a single thread, its habitation. It continues, then, to form the interior, and the closest to its own body, by means of a glutinous moisture, a compact, felt-like vault, in which, after four or five days, it becomes a nymph, to repose, in that secure retreat, unhurt by wind or weather, and quietly awaits its approaching resurrection. The colored plate represents, distinctly, these different states. The chrysalis, as we have said, must be killed, before it becomes a butterfly.

§ 70.

10. *A Cocoon, from which the butterfly is near emerging.*

The cocoons which are reserved for being pierced by the butterflies, require the following attentions:

The cocoons are laid upon separate hurdles, or upon a table, in boxes lined with linen or paper, like those in which the worms had been kept, or simply upon a sheet of paper, or a linen cloth. The room in which this is done, must not be upon the first floor, and the temperature of the interior atmosphere must be from 15° to 18° (66° to 72°

5, Fahr.) If it be lower, the oven should be heated; and, if it be higher, the cocoons should be removed to a cooler room. If the air be moist, means should be taken to dry and purify it. From the day that the worm has spun its silk, an interval of twelve, sixteen, or twenty days follows, in proportion to the heat, before the butterfly emerges. The approach of this state may be known from the cocoon becoming somewhat moist, and from frequent signs of unsteadiness. The room must also remain light enough to distinguish the objects which it encloses. The butterfly generally makes its appearance in the first three hours after sunrise.

§ 71.

11. *A Cocoon from which the butterfly has already escaped.*

The worm, metamorphosed into a butterfly, has now escaped from its prison, to enjoy a free life, and seems to have no other wish than to couple immediately, to propagate, and to die. The males may be distinguished from the females, by the fluttering of the wings, and by a comparative smallness. The flutter lasts until the male has found a female. Besides that the latter moves seldom, and stirs her wings very little, she is also bigger round the body. To prevent the coupling from taking place immediately upon the cocoons, as soon as the butterfly comes out, it should be taken by the wings, and laid upon the linen cloth, or the paper. If there are some already engaged in coupling, the pair should be seized, simultaneously, in the manner abovementioned.

It would still be better if the cocoons had been previously sorted, in regard to the difference of sexes, with a view of managing the coupling, with more regularity: every thing can then be better observed; the moths that have coupled, can be removed; those that are not yet prepared for it, can be left quiet in their places, to give them time to throw off a part of the liquor which they contain, mixed with earthy particles. If the males are too numerous, part of them should be put aside, to prevent them from disturbing the others.

§ 72.

12. *Two Butterflies in the act of coupling.*

When they are seen in this state, they must be put upon the frame, represented in the cut fig. 8, page 75, or if there are none ready, they may be laid upon paper, or a linen cloth. The coupling is known by a certain tremour of the male which is upon the other moth. Shortly afterwards, both must be gently seized by the wings; and when separated, they are put according to their respective sexes, male by male, and female by female, or the male alone must be taken away. If there remain, yet, some butterflies after the coupling, they may be put in a band-box, pricked with holes, like the one represented in page 75 (fig. 7) until the proper moment of coupling has arrived. The

room ought to be kept dark, and the interior air pure, and in the temperature abovementioned. The male butterfly must remain paired from six to eight hours at least, and is then only removed. If there be not a sufficient quantity of them, the males ought only to be left with the females five hours; after which, the strongest are selected, to be laid, for a while, in the band box, and are afterwards brought together, with another female moth, whereupon they proceeded to a second coupling. Generally, the butterflies pierce at 6 or 7 o'clock, couple at 8 o'clock, and between two or four o'clock, in the afternoon, this act is accomplished. The male and female moths may then be separated. The former die a few days afterwards, without having taken any food in the interval, or done any thing beside the single or double propagation.

§ 73.

13. *The Female Moths laying eggs.**

Mr. Bonafous uses a sort of easel, covered with linen on both sides, whereupon another linen is extended for the eggs. The female moths are arranged one after another, from the top to the bottom of the canvass; but this is not indispensable. The moths may be laid at a proper distance from each other, upon a table, covered with paper or a linen cloth, where the process can be distinctly observed. The moth lays the greatest number of eggs in the first 36 or 40 hours, and afterwards the 6th part, only, of that number. On an average, each lays from 400 to 510. The purity of the air, the temperature and the obscurity, recommended above, must never be neglected. According to the temperature, the natural narcissus color of the egg grows darker, and becomes of a reddish grey. The eggs go within 15 or 20 days through these changes, and may then be considered as completed. A few days afterwards, when they have assumed an ash-grey color, the paper or cloth, on which they are lying, is lifted up, folded four or eight times, and put in a cool dry place, where the temperature in the Summer does not exceed 15° (65° Fahr.) and does not fall to zero in the winter. The best is to lay the packet upon a cloth, which is fastened at the ceiling of the room. During the hot season, it should be examined every fortnight, whether the eggs are not exposed to moisture, which would injure them. They must also be preserved from dust, mice, and rats. To convey them to a distance, they must be put, in the Autumn, or early in the Spring, in paper bags, or within reeds, the extremities of which should be covered with clean linen; and if they are to be sent very far, they should not be lifted from the linen cloth; but the whole packet is to be enveloped with muslin, over which you make another cover of paper, as if it were a letter.

* The branch or leaf of the mulberry tree, represented in the plate, should not be overlooked. It is less indented, than the others, and larger and rounder, because it proceeds from a grafted mulberry tree, or a tree that may be used for grafting, as has been explained in § 53. This species of leaf is very valuable.

This method was followed in the laboratory of the Agricultural Society. The eggs were left upon the paper, where the moths had laid them, and the papers were deposited, until the ensuing Spring, in a small room, with a northerly aspect, and in which no fire had been made during the Winter. As the eggs were to be sent away in the Spring, sheets for an ounce or a drachm were used, which were cut in smaller portions, according to circumstances, and put under cover, to be thus forwarded by mail. The eggs reached their destination with safety, with the exception of a few, which, from the great distance, and the heat, were hatched shortly after having been received, and when the mulberry leaves had not yet shot. The Italians, if such an accident happens to them, put the worms in small bags, which they cover, on both extremities, with meal. The worms live in this manner several days without food, until the leaves appear; and this experiment has also been tried in Bavaria with success. The eggs are sometimes preserved in glasses, and sent in this way to a distance, covered with paper, pricked with holes. The eggs are scraped off from the paper, or linen, upon which they are lying, and which are put on a tray, and a little old wine is poured upon, which must be neither mulled nor sulphurated. Two hours afterwards, within which time the paper or linen should be stirred, now and then the eggs can be scraped off with a blunt knife, and washed with the wine, which is afterwards filtered into an earthen vessel. The eggs should be spread upon a perfectly smooth board, and laid in a cool place to dry, before they are put in the glasses. But the method more generally followed in Bavaria is the best. Some think that a change of place is as profitable for the seed of the silk-worm, as for that of garden plants and grain. But the rearing will succeed more certainly with eggs obtained upon the spot.*

§ 74.

14. *Raw Silk, of a yellow or white color.*

Within six or eight weeks, all that belongs to the culture of silk has been accomplished; and in the plate before the reader, two sorts of silk are represented, one of a yellow, and the other of a white color; both of which have been reeled from one cocoon. On an average, from seven to ten pounds of cocoons give one pound of silk, which, when carded, sells at 16 or 18 florins, and, when spun, from 20 to 24 florins. One pound of cocoons generally brings one or two florins, independent of the floss and the real floret-silk, which proceeds especially from the pierced cocoons. Nothing very accurate can be said in regard to the number of cocoons that may be averaged to the pound—the data collected, in this respect, varying considerably. Of

* We must here mention the experiment tried by Mr. Melallier, in 1818 and 1819, near Lyons, for a second crop. The eggs were hatched on the 26th of June, and the 15th of July: the worms were healthy and as large as the former. The cocoons were, also, equally fine. This experiment, we are informed, has since been renewed, frequently; and this may serve to encourage a hope of further trials and discoveries.

the best cocoons, from 225 to 250, of the middling 300, and of the inferior, from 400 to 600,* and upwards, weigh a pound. This shows how much depends upon the nourishment and the rearing of the worms, which determine the quality of the cocoons, and consequently their value and weight. A pound of floss silk sells at 1 or 2 florins, and a pound of floret-silk at 4 or 6 florins.†

§ 75.

15. Here is represented the excremental substance of the silk-worm, in its first and last age. For details on this part of the subject, the reader is referred to what has been said above. (§ 63.)

§ 76.

Of the diseases of Silk-Worms.

The silkworm is a robust little animal, and its organization is simple; but the rearing of it is often so defective, that, notwithstanding its

* An article in Mr. Dingler's interesting Polytechnic Journal, (Vol. xx. No. 3, 1826,) deserves the more to be transcribed here, as this book, like the *General Advertiser for Germany*, has furnished, for some time past, several valuable remarks upon the culture of silk, and contributes to raise in Germany a new spirit in favor of this industry.

"*On the produce of the rearing of Silk-worms in Italy.* The *Continuazione degli Atti dell' J. R. Academia Economico-agraria di Georgofila, Firenze,*" contains in the Art. No. 21 of the fourth volume, a letter from Mr. Lambruschini to Doctor Passerini, on the success which attended the culture of silk, after the method suggested by the celebrated Count Dandolo. Mr. Lambruschini obtained a clear profit of 28 per cent. upon a capital of 1,500 lires, within six weeks, and in a year little favorable to the culture. Mr. Acerbi, the distinguished Editor of the *Bibliotheca Italiana*, far from believing that this result is exaggerated, mentions the fact, that one of his countrymen, near Milan, obtained, from two ounces of eggs, fifty pounds of cocoons, and, consequently, that, by an advance of 66 lires for mulberry leaves, he made a profit of 128 per cent. within six weeks, rating the pound of cocoons at 3 lires only. He is convinced that no branch of industry is more productive than the culture of silk, if it be well understood, and pursued with intelligence.

"In regard to Germany, we must, before all, proceed to the plantations of mulberry trees. Twenty and more years will elapse before these trees will attain a sufficient growth for the pursuit of that industry, on a great scale. Those who are unwilling to lay out profitless, for twenty years, the capital required for the purchase of land, and the rearing and the management of the trees, must not expect to make 128 per cent. in six weeks. 'Sow before you can reap.' Private persons may feel reluctant to lay out a capital, the interest of which will be gathered by their children or grandchildren only. But, if a Government be willing to enter upon similar enterprises, too many examples, and, namely, those of Maria Theresa, and the Emperor Joseph, in Austria, of Frederic II, in Prussia, and of the late Electors Maximilian and Charles Theodore, in Bavaria, will discourage them, by instances of a return of ingratitude for a generous solicitude, for much wisdom, and a paternal love, on the part of sovereigns. Such are the causes from which all endeavors to introduce the culture of silk in Germany have failed, until the present time; and they will only cease to exercise their mischievous influence, when the bulk of the nation will be more enlightened in regard to their economical interests, and enabled to discover the advantages they would derive from substituting for useless or noxious trees and bushes, the valuable mulberry, which thrives in every soil, and can even be planted as bushes."

† The mulberry trees bear a great price in Italy, and France, and form an important branch of culture and industry. A considerable number of them, which are planted in the streets, and in places of public resort, are disrobed by the poor, and by children, without any expense.

sound constitution, it frequently perishes from the ill-management it experiences in its rearing. The several torpors which terminate the different periods of its existence, must not be reckoned among its natural diseases; they are, on the contrary, essential for its destiny, and the functions it is doomed to perform. They are an additional evidence of its admirable organization; and those worms which do not pass through these crises, are unfit for their principal destination—the spinning of silk. The diseases are—

1st. *The Gras*, (*La Grasserie*)—A general swelling, which appears during the moultings. The worms affected with this disease, eat and grow, but they cease to spin, and are whiter and more clammy than the others.

2d. *Consumption.*—The worms affected by this disease, have an exhausted appearance, and they grow slower than the others. They do not feed, grow soft to the touch, and are frequently suffocated by the other worms. In the hands of unskilful rearers, this disease makes rapid ravages, chiefly after the third moulting has commenced.

3d. *Jaundice.*—This disease differs from the *Gras* only with respect to the time at which it makes its appearence. It begins after the fourth age, when the worms are near spinning their silk, and it is greatly ascribed to the infiltration of the nutritious moisture, and of the silky matter. Instead of attaining their maturity, they swell, and gold colored spots become visible upon their bodies.

4. The *Numbness* (Muscardine.)—The worms grow stiff, and die in any age that they are attacked by this disorder, even after they have begun their cocoons. Their color, which at the beginning is scarlet, becomes white. The disorder is discernible after the death of the worm, by the hardness of the body, and a sort of mould with which it is covered. It was long doubted whether this disorder was contagious; but experience has shown that healthy worms, brought together with some that were attacked by the *muscardine*, were infected by them. It is, therefore, indispensably necessary to clean well the room, the vessels, and all the instruments, whenever the disease has any where made its appearance, and to separate carefully the healthy worms from the sick.

Besides these principal disorders, there are yet many others which kill the worms, when they are not well tended. At the approach of the time of the formation of the cocoons, some worms seem transparent, which proves that they are filled with water. They do not spin their silk, and die soon. The French distinguish them by the name of *vers clairs*. Other worms seem to search in vain for a place where to spin their silk, or, as if they were affected by the weather, they exhaust their strengh, and the silky matter thickens in their bodies, so that they soon die, without having made their silky bag. In French, they are called *vers courts*. Upon discovering any worms in this state, they ought to be carried away, or deposited in another room, where they might, perhaps, still spin their silk, though of a coarse kind.

There may be sometimes worms which, being dead, preserve a fresh

and healthy appearance, except that they are very soft to the touch. Their disorder is called *tripe sickness*, and the worms attacked with it, bear in French, the name of *morts blancs*. Those who pursue the culture of silk, upon a great scale, do not trouble themselves much with the many lazy, weak, exhausted, and sick worms, but cast them away; but some persons sort them, and endeavor to make some use of them, especially of the lazy worms, as has already been said in § 68. It is evident that all the disorders originate from a suppressed perspiration, an excessive, or insufficient, or unwholsome food; such as dusty, moist, and mildewed leaves, from uncleanliness, and from a want of attention to the temperature of the place where they are kept. If every necessary care is taken, no disease will appear; and, by-the-way, the same will happen with every organized animal.

The worms that have been fed too copiously, can be cured before the swelling *(la grasserie)* has made considerable progress, by separating them from the others, and by subjecting them to a regular diet. The want of food, which commonly happens during and after the fourth age, from the great quantity which the worms then eat, and from a miscalculation of the quantity of leaves, of which there is a provision, can only be remedied by casting away a portion of the insects. The best thing that can be done in the jaundice,* and in the other diseases, is to separate the sick worms from the healthy, to save, at least, the latter, and to prevent contagion. Experience warrants the further remark, that, in the culture which was pursued, during four years, in the building of the Agricultural Society, no disease has been observed among the worms; and that not twenty from among many thousands have perished, although no other care was taken, than to keep the laboratory very clean.

§ 77.

Of the Diseases occasioned by the Culture of Silk.

It must not be concealed, that some antagonists of this industry, have maintained that it is injurious to the human constitution. But this is a mere prejudice, or a vain pretence. No human being, has, yet, suffered bodily from this cause. The French and the Italians would laugh at any one who should endeavor to alarm them with such fears; and there are in Prussia, as Mr. de Turk observes, many families, who have been pursuing the culture of silk for a number of years, and have, nevertheless, reached the greatest age than man can attain. Many similar instances may be found in Bavaria.

§ 78.

Of the Enemies of the Silk-worms and the Cocoons.

The enemies of the silk-worms are sparrows, swallows, robbins, the titmouse and other birds of this kind; care must, therefore, be

* Count Dandolo has offered a prize of 150 louis d'or for the discovery of an infallible remedy against the jaundice: but it is yet to be won.

taken to keep the windows closed against them. Fowls are also in wait for them, and, not less, mice, rats, weazles, lizards, ants, and spiders. These latter make, perhaps, the most active war against them. They place themselves upon their necks, and sting them to death, as if it were from envy, that the silk-worms excel them in the art of weaving. Spider-webs ought, therefore, to be carefully cleared away, and all possible precautions should be taken against the other enemies, which beset these poor insects. Thunder and lightning have been added, but wrongly, to this long list of perils.

If the cocoons are keep too long, especially in a close room, they are exposed to a particular species of moths, which pierce them on all sides; and, in consequence of which, they are, at best, useful for floret silk only, and are not unfrequently entirely destroyed.

§ 79.

Of some particular species of Silk-Worms, and that with white cocoons.

To complete our exposition of the culture of silk, we must yet mention that species of silk-worms, known in France, which have but three moultings, and spin their silk at the end of the third age. Their eggs weigh one-eleventh less than those of the common silk-worms, and their cocoons are too-fifths smaller. They need, daily, nevertheless, as much food as the others. In the first and second age, they eat as many leaves as the ordinary worms in the same period of their lives; but they want much more in the third, when they are extremely voracious, especially upon the midribs of the leaves. The cleaning must be attended to on the fifth day of the third age, as, with these worms, this age is longer than with the others. Their cocoons furnish a finer and more beautiful silk; they are more finished, and the manufacturer derives from them, proportionally, a greater quantity of silk. These cocoons are, nevertheless, less sought after, than those of four moultings. Their rearing is but by four days shorter; from which circumstance, the mulberry trees are sooner stripped of their leaves; thus, time and money are equally expended; but, as these worms have a shorter life, the risk of losing them is less. Combining these circumstances, Count Dandolo recommends particularly this species of culture of silk. There is, besides, a species of silk-worm which invariably furnishes white cocoons.*

With respect to time and to management, their rearing is the seam as that of the other species. Their increase would be advantageous to the silk manufacturer, on account of the natural white color of the silk; which, therefore, can be employed without any preparation in the fabrication of such stuffs which require the pure white color, which it is impossible to imitate. But the produce of the common yellow cocoon is said to be greater.

Intelligence received from Italy, within the last year, gives the following view of these three species of worms, as they are found in

* The Agricultural Society has a supply of them, and is willing to distribute them.

that country: "Two principal species of worms are reared in Piedmont. The cocoons of the one are yellow, and belong to the most common species. Those of the other, are white, and the species which furnishes them, is principally reared in the neighborhood of Novi. There is a third variety in France, in the environs of Alais, which the Government procured from China fifty years since, and which produces a very white silk. Mr. Bonafous, of Turin, has instituted comparative experiments, with a specimen of the latter species which he obtained from a pure breed, belonging to a cultivator of Alais, and the white one of Piedmont, with an equal quantity of eggs; and the result he obtained, warranted the conclusion that the greater whiteness of the Chinese silk, is too small a superiority to be considered as a compensation for the less quantity which is obtained from a rearing perfectly equal, under all circumstances, of both species of worms."

But all such calculations depend on the wants and means of the silk manufacturers.

§ 80.

III. *Of the means within the power of Government for promoting the culture of Silk.*

According to the maxim laid down in section 28, *No Board connected with the government, no particular administration, no public officers, no expenses. The culture of silk shall be an affair wholly belonging to the People, an incidental business, the secondary task of servants, children, paupers, and old people. Encouraged by the example of Greece, Italy, and France, we wish to trust it to the fair hands of ladies, who could, by way of amusement, and without any expense, obtain, within six weeks, a more elegant material for the ornament of their persons and apartments.* The intervention of a Government can only consist in encouragement and protection. The management of the culture, and of all the collateral branches, will prosper better in the hands of a society, acting at the impulse of a fond predilection for the pursuit, and of patriotism, and accordingly is sure to succeed more completely, and more promptly. Such motives occasioned the formation of the Board of Silk Culture in Bavaria, and explain the success which it has already obtained. Composed of persons well acquainted with the subject, each of them renders the services for which he is the most adequate, and all strive for the same end, from the purest interest for the welfare of the community.

§ 81.

The encouragement which a Government can, and should afford, would be evident—

1st. By procuring from abroad a large number of good mulberry trees, and seeds of the mulberry, and of eggs.

2d. By the plantation of the trees on public squares, and other places of public resort.

3d. By the directing the foresters and gardeners in the service of Government, to attend to these new plantations.

4th. By facilitating the means of extending the knowledge of this branch of rural economy.

5th. By stimulating schoolmasters and country clergymen to take interest in the same.

6th. By offering prizes for the most industrious cultivators of silk.

7th. And other such premiums for the greatest number of cocoons.

The protection may be evinced—

a. By protecting the mulberry trees from damages.

b. By encouraging silk-cultivators to settle in the country.

c. By securing the consumption of the national produce in the country; and

d. By offering bounties for the exportation of the same.

§ 82.

1. If a society, like the Silk Company of Great Britain, have sufficient means for purchasing mulberry trees, &c. &c. they need no pecuniary assistance from the Government. The Agricultural Society, and afterwards the Board of Silk Culture in Bavaria, entered upon the undertaking, as has already been said, with their proper resources, and might not have wanted any advance from the Government—for the Board distributed, in the course of two years, a great quantity of trees, seedlings, and still more of mulberry seed, without any remuneration; but it was to be foreseen that, in this way, the end would be obtained but very slowly, and that the zeal for the new culture might meantime decline again. The Board accordingly solicited from the States General of the Kingdom, in 1825, a pecuniary assistance, and the House of Representatives evinced a warm interest for the subject, and defended it.* I repeat, if there were no pressure of time, no money would be necessary to purchase the trees indispensable for the culture. A few florins are sufficient to procure seed from Italy and France, and such an expense will never fall heavy on any company. With the seed, there would be hedges within five or six years; and, within twelve or fifteen years, there would be standard trees, from which a sufficient quantity of leaves could be gathered. The same result might be obtained within two years, in purchasing, for instance, in Italy, trees or seedlings, which, in that country, cost but little, and the transport alone is expensive. To gain time, such a purchase might be advisable for every country; and we may mention as an example, well worthy of imitation, a rescript of His Majesty, our reigning monarch, published shortly after his ascension to the throne, and by which he has become the greatest protector of the culture of silk in Germany. It was addressed to the General Committee of the Agricultural Society, and is as follows:

* The reader is referred to the Journals of the States General, and to the reports laid before the House of Representatives; especially the one written by Baron de Closen, (1825,) in which mention is made of my own detailed *Exposition of the progress and actual state of the culture of silk, and its wants.*

"By the rescript of the 11th of December, 1825, His Majesty has been pleased to grant to the General Committee of the Agricultural Society, for the two years of 1825 and '26, and 1826 and '27, as a first means of encouraging the culture of silk, the sum of six thousand florins, which the said Committee of the Agricultural Society was directed, in concurrence with, and chiefly upon the suggestions of, the Board of Silk Culture, connected with the aforesaid Society, to employ in the distribution of mulberry seed and eggs, *gratis*, to such persons, or public authorities, as should make application to that end; and in procuring mulberry trees and seedlings, in preparing prizes for cocoons, in providing for such instruments and regulations, as would be the most necessary, and in extending the art of reeling silk, &c.

"Whereupon, the Board caused, on the 2d of May, 1826, the following advertisement to be published:

"*Recent progress of the Silk Culture in Bavaria.*

"Through the generous assistance of His Majesty, of which the public has already been informed, the Board of Silk Culture was enabled to procure from Italy a considerable number of mulberry trees: Six waggons of them arrived here on the 3d of April, with 5,740 standard-trees; 23,000 three-year-old seedlings; several hundred scions; and twelve first-rate mulberry trees: thirteen pounds of mulberry seed, (fifteen pounds of our weight,) and sixteen ounces of silk worms' eggs.

"The whole arrived in perfect state of preservation, and the prices and the other expenses have been moderate.

"The Deputation has immediately proceeded to the distribution of these means of pursuing the culture, proportionally to the demands that had been made by the public authorities, or by private individuals, in the Circles mentioned in the following statement, which, at the same time, shows the quantity and the nature of the things distributed:

CIRCLES.	Standard Trees.	Seedlings.	Mulberry seeds.	Silk Worms' Eggs.	
			lbs. oz.	*Ounces.*	*No. of Eggs.*
Isar, -	2,124	6,534	4 15¼	8	13,500
Lower Danube,	506	1,910	22½		
Regen, -	446	1,292	29¼	5	12,600
Upper Danube,	529	1,437	8½	1	17,400
Rezat, -	628	2,246	25½	4	13,000
Upper Main, -	519	900	28		
Lower Main, -	646	1,310	12¾	–	5,000
Rhine, -	348	802	8		
	5,746	16,431	14 21¾	21	61,500

"There are, however, in the nurseries of Nymphenburg, Schleissheim, in the garden of the Agricultural Society, and in several parts of the Kingdom, many thousands more of these trees, partly procured from Italy, and partly raised from seedlings. Adding to all these, the hundreds of trees and seedlings that have been distributed, within the two last years, by the Board, from their own means, the several pounds of mulberry seed, and the fifteen pounds distributed recently, each ounce of which may be estimated at ten thousand seeds, it will be seen that, in the present Summer, there are many thousands of trees and millions of seedlings in the Kingdom. Considering, also, that within four years, many ounces of eggs, and that, in the present year, twenty-one ounces have been distributed—that each ounce yields 20,000 worms, and that several cultivators, principally in the circles of the Upper and Lower Main, have purchased such seed—it may safely be assumed, that there will be, in the ensuing month of June, at least half a million of silk-worms in Bavaria. It was gratifying to observe, that not only many hundred individuals from the several circles in which the Kingdom is divided, solicited mulberry trees, &c. but that all the public authorities made similar applications for the Wood and Forests and Salt Administration, as well as many public institutions, tribunals, magistrates, the Royal Court, Marshalship of Wurzburg, the Royal Garden-Intendancy, clergymen, school-inspectors, and school-masters. There is little doubt that the trees will be managed according to the directions given in the published instructions, as hereafter new distributions will be made to those only who shall be able to prove that they have followed them carefully; and, finally, it may be expected, that, according to the benevolent intentions of His Majesty, the country will possess, within a few years, in the culture of silk, an important branch of industry and of public wealth."

§ 83.

2. The Government can encourage the respective authorities and communities to plant mulberry trees in all places of public resort, in church-yards, in the gardens of hospitals, schools, and other national institutions—such as the theological seminaries; these trees being not only a fine ornament, but highly calculated to enlarge the resources of the country.

§ 84.

3. The King, and his personal servants, by condescending to give the laudable example to introduce these trees into the Royal Gardens and Plantations, the whole country would feel encouraged to imitate it. The distribution of trees might then be easily enlarged. By such means as we had already mentioned, the culture of silk prospered in France, under Henry IV.* An equally great model will be our most

* Through Olivier de Serres' active exertions, a short time was sufficient to enrich the gardens of the Tuilleries, in Paris, with twenty thousand mulberry trees, and to lay the ground, in France, for the culture of silk.

gracious Sovereign. More has been even done already in our country; for all the Royal Wood and Forests authorities have been directed to attend to the planting of mulberry trees; and thus, that branch of the public administration has been awakened to its true destinies, viz: to furnish and to provide for the multiplication of the finer species of trees, which may contribute to extend the industry, and enlarge the resources of the country; skilful and intelligent gardeners, instead of providers of fuel only. The two Royal Regulations upon this subject are as follows:—

"*To the General Committee of the Agricultural Society of Bavaria.*

"His Majesty having directed me, by his Royal Order of the 28th of February last, to make an extensive plantation of mulberry trees in His Majesty's gardens, by means of which a considerable quantity of trees, well-grown and well-reared, and accustomed, from the beginning, to the soil and climate of Bavaria, might be distributed every year, I respectfully beg the General Committee of the Agricultural Society to incline the Board for the Culture of Silk to deliver, before the ensuing Spring, the greatest number of trees they can dispose of, in order that I may be enabled to obey the commands of His Majesty.

"I have the honor to be, &c. &c.

"SKELL, *Inspector of the Royal Gardens.*

"MUNICH, *March* 4, 1826."

"*Plantation of mulberry trees in the Royal Forests.*"

"Circular letter of the Treasury Department, to all the Regencies of His Majesty.

"The King has been pleased to grant to the respective circles, considerable pecuniary donations, for the promotion of the culture of silk in the Kingdom, and to manifest a wish that all possible attention and support may be given to this branch of industry. The officers of the Administration of Woods and Forests would seem to be the best situated to contribute to the progress of this industry, were they directed to rear, on proper spots, mulberry trees from the seed; to enable, afterwards, those who devote themselves to the culture of silk, to transplant them.

"The Chamber of Finances will, therefore, not neglect to fulfil His Majesty's intentions, in directing and enabling wardens and other officers of the Forests, the most apt to further this end, to contribute to it, with all their means. There is surely no want of places in the Royal Forests; and it will not be difficult to prepare the soil for the seed, nor to shelter the spot selected for the plantation. The real and only difficulty consists, therefore, in procuring the mulberry seed; and, in order to remove this difficulty, nothing more is requisite than to co-operate with the General Committee of the Agricultural Society.

"As undoubtedly, the Regency will be willing to adopt all the regu-

lations, which this important subject may require, it is expected that detailed accounts will, in due time, be received of the measures that have been taken, and of their results."

"MUNICH, *January* 8, 1826."

§ 85.

4. It is the more necessary to extend the circulation of the printed instruction concerning the best methods of planting and raising mulberry trees, and of managing the silk-worms, as an imperfect knowledge of this culture was the main cause of its decay. For the cultivator, who pursues it on a small scale, a few pages will be sufficient. But those who mean to carry it to a great extent: public officers, clergymen, schoolmasters, and especially the fair sex, will need more ample directions, as they not only should be more instructed for their proper advantage, but to be the abler to advise and guide others. The Society, which is engaged in the direction of the culture of silk, must, therefore, provide for an extensive circulation of such printed instructions, according to the example given by the Board of Silk Culture in Bavaria, who have abundantly distributed such instructions gratis. A Government can easily do all this, and without much expense, and ought to do it, on the ground that this industry cannot be considered as established in a permanent and profitable manner, unless an adequate knowledge of its management be generally extended.*

§ 86.

5. Much will be gained, in this respect, from the day that clergymen and schoolmasters will take an interest, and become public teachers in the art of cultivating silk, after having acquired the knowledge necessary for the pursuit, in seminaries provided with mulberry trees. They should induce the fair sex to pursue this industry, after the example of the Chinese, Greeks, Italians, and French. Among these two latter nations, the culture of silk is chiefly committed to the charge of female servants, in whose indentures this task is generally expressly mentioned, and this is done by leaving to them the foliage of a few mulberry trees; by giving them a certain quantity of silk-worms' eggs, and by permitting them to sell the cocoons for their own profit.

§ 87.

6. Ambition and honor are two powerful impulses of human actions. Both should be called into action for the end we speak of. The Go-

* I have just read a report inserted in the Transactions of the Economical Society of Moscow, which had been addressed to them by Mr. Castelle, on the 27th of February, 1826, and from which it appears, that, although the culture of silk had been neglected in all the other provinces of the Russian empire, it has nevertheless made such progress in the Caucasus, that the Russian manufacturers are enabled to use native silk. For this, the Russians are indebted to the wives of some soldiers, who were instructed in this art; and the merit of this improvement is ascribed to the Generals Jermolow, and Welzaminow.

vernment ought to offer yearly premiums for improvements in agriculture and industry. The most active cultivators of silk, ought to have the chance of obtaining the prizes. There exists already, in Bavaria, such a system, and the agricultural festivity of October, is not lost for the silkweaver. The greater the prizes, the greater the emulation will be.

§ 88.

From the beginning of the culture in France, premiums were distributed to those who pursued it, and namely, 30 sols per pound, in preserving the right of disposing of the produce. Similar encouragements were granted in Austria and Prussia. It is natural, that those who were at so much trouble to procure the cocoons, should wish to know how to dispose of them. If there be, independent of a certainty of selling them, a reward for their production, the industry cannot fail to prosper rapidly.

Premiums were formerly also distributed in Bavaria; but it seems that in this kingdom, as well as in Prussia and Austria, some abuse took place in the distribution; as in each of these countries, complaints became general in regard to the diminution of the cocoons, and the impossibility of making any profit by them. Several pounds of them, eaten indeed almost wholly by worms, that had been collected in the long interval from 1780 until the present year, have been sent to the Board of Silk Culture, in Bavaria, as soon as it was known that the Board was willing to pay a florin for the pound; and the persons who sent them, observed that, formerly, the Electoral Silk Directory made difficulties to purchase them. As has just been said, the Board thought that, independent of the price, a premium ought to be paid; and, accordingly, they informed the public, by an advertisement, dated September 6th, 1825, *that they would pay one florin for the pound of killed and sound cocoon; provided it be accompanied by a certificate of a competent authority, stating that it had been obtained, by the person who sends it, from the culture pursued by himself, and from mulberry trees planted within the Kingdom.* The Board caused the cocoons that were sent them, from 1823 to 1825, to be fabricated, at their expense, into ribbons, handkerchiefs, and other stuffs, and proportionally distributed these manufactured articles to the persons who had forwarded the cocoons. Of course, those who prefer to keep them, with a view of selling or manufacturing them themselves, are perfectly free to do so.

The measure adopted by the Board, has no other purpose than to ensure to the cultivator a market for his produce: money in return for his labor; because this is the best method of encouraging any industry. It is clear that the Board cannot sell them at the purchasing price, principally when there are no silk manufacturers. They make, therefore, in the beginning, some sacrifices by the difference of the price they pay, and the money they receive. This includes, however, the premium; and it is obvious, on the other hand, that, when once there shall be a sufficient sale for cocoons, silk manufacturers will soon form establishments; competition will arise, and the price of the co-

coons will increase. Within a few years, the Board will no longer be obliged to purchase them, but may leave them for the search of private individuals; because the sale will be certain, when once the fabrication shall have made some progress.

§ 89.

We come now to the *protection* which Government is able to afford to the culture of silk, and it is of great importance; because the most auspicious beginning would remain without ultimate result, if such assistance were wanting.

a. In many parts of Germany, young fruit trees and the like, planted on open places, are not secure from the attacks of wanton rudeness or malignity, and not a few are cut down, during the night. Severe enactments tended, at an early epoch, to obviate this evil; and new regulations have been published to the same effect. It is but thirty years that the traveller's eye was truck by boards fastened to trees, representing a hand cut by an axe, or nailed to a wheelbarrow, as a monitory intimation of the punishment which awaited every person that should damage trees; but there was, in this, more show than reality. To this day, to this hour, no young plant is secure. We could mention a considerable town in Bavaria, where, but a few weeks ago, some remnants of the former mulberry plantations were cut down, in a single night, from no other motive, than because a distinguished schoolmaster used them for an attempt to cultivate silk. The new plantations may have the same fate, if some preventive measures were not taken; for the greatest part of the alleys which adorned the public roads of the kingdom, twenty years back, had no better luck. This occasioned, then, an ordinance that may be found among the acts of 1805. It enumerates the several species of offences: "for which injuries, committed on either fields, "meadows, gardens, single trees, or forests, the villagers in whose "precincts such an offence has been committed, or, in case of damages "caused by game, the owner of the same will be answerable for the "reparation. But, if the criminal be arrested, he shall be obliged, in- "dependent of a public punishment, to pay threefold the value of the "damage he has committed; one part of which will be for the plain- "tiff, and the other two for the treasury of the community, as a com- "pensation for the disbursements they will be compelled to make, "when the criminal is not known; and if, in case of being arrested, "he is not able to pay threefold the value of the damage committed "by him, he shall pay it by his labor, at the rate of the daily wages of "a hired workman, and the third part of the same will be allowed "for his personal maintenance. If the amount of the damage be con- "tested, the plaintiff shall be permitted to state it under oath; the "judicial authority being, however, entitled to interpose its own de- "cision, and leaving to the parties the recourse of appealing to the "higher tribunal, after fourteen days."

This regulation saved many meadows, and strengthened the zeal for

the plantation of fruit trees, at a time when there was, in reality, no need to encourage agriculture in Bavaria. It is obvious that such measures are now indispensable. If, for each damage, a long litigation must be instituted against an unknown offender, the injured individual is deterred from claiming his right, or his taste for agriculture is checked. A community has more means of detecting the offender; as, generally, he is one among them, and each of its members is interested to discover him, and give him up. Experience has confirmed the fitness of these regulations, and their strict maintenance is probably the only means of protecting the projected mulberry plantations.

§ 90.

b. To relieve the Society for the Promotion of the Culture of Silk from purchasing all the cocoons that might be brought to them, and to give rise to a greater competition, it will be necessary that more silk manufacturers, weavers, &c. &c. should form settlements. They will be the more indispensable, as it is desirable that the fabrication of silk should go apace with the production of the material—the former being ever more profitable than the latter. Government should, therefore, take care to attract skilful manufacturers, to render their settlement in the country easy, and to encourage and to protect them. When the raw material shall exist, there will be no difficulty to gather together persons able to turn them into stuffs and the like, if no obstacle is expressly or unintentionally created against their coming and their settling in the country.

§ 91.

c. In order to combine the fabrication with the production of silk, it may be necessary, *in the beginning*, to provide means for securing a national market to the cocoons and the silk derived from them; because, otherwise, an infant culture and fabrication would easily be crushed by foreign competition, as young plants are suffocated by lofty trees that overshadow them.

§ 92.

d. To promote the internal production and fabrication of any article, other States, as, for instance, England and France, have granted, from the public treasuries, bounties on the exportation of such articles, and this liberality has produced a very good effect. This system might be successfully applied to silk products, and might serve to invigorate the culture, as well as the fabrication of that material. But the bounty for exportation can only come into use when the production has already made a great progress, and when no premiums are longer necessary for the cocoons, which would find an easy sale without such an assistance; and the money which, accordingly, is saved upon that head, may, therefore, be applied to the payment of export bounties,

which may not unaptly be compared to the seed whereby a country thrives, at once, in its means of production and fabrication, and consequently in its population and wealth—which are the richest crops that political culture can aim at.

§ 98.

IV. *Of the manner in which a "Society for the Promotion of Silk Culture" should proceed in the sphere of its activity.*

The sphere of its activity is sufficiently indicated by what has been said in § 28, and is exemplified by the fundamental principles which have been laid down for the organization of the Board of Silk Culture in Bavaria. Should, however, any one again ask, "But what does the Board do for the culture?" the answer would be easy and simple. At present the Board attends to the following objects:

1st. To the planting of mulberry trees.

2dly. To the procuring of silk-worms' eggs; and

3dly. To the advising in the management of the same, &c.

When these three ends are obtained, then, and then only, begins the fabrication; and, for this latter result, some preliminary measures have also been taken.*

1st. The Society should make experiments, upon their own plantations, with all sorts of mulberry trees, with the graft, &c. &c. and publish the most remarkable results of the culture, and answer to the queries that might be addressed to them respecting the means of promoting it. The Society should endeavor to extend the plantations of mulberry trees. They are, as it were, the central school, where advice and instruction may be sought after, from everywhere; and they should be equally attentive to keep up standard trees, as to have a provision of young plants, in order to be ever ready to supply each demand; and, finally, they should take care to preserve the best mulberry seed.

2d. The Society should be careful in the choice of the silk-worm's eggs, to the end that they may be able to satisfy, in this respect also, every demand: and this is not all. They should pursue, upon a small scale, at least, the culture of silk, and institute experiments to improve it more and more, and to be able, if possible, to publish some new interesting facts.

* Mr. Wurz, who attends not only to the culture of silk, but also to the reeling and spinning, has been provided, by the Board, with a reel of a modern construction, imported from Italy, and with a portable filature. The King has, besides, granted him 3,039 florins for the purchase of a warming cylinder, to enable him to give to the silk a brilliancy not inferior to that of the French. His looms are, besides, constructed upon the best and most modern French models; and they ought always to be altered, according to the improvements which are successively made in these engines. When there will be a greater market for the cocoons, a portable filature will, of course, be insufficient. A larger one will become necessary, like the one which formerly existed in the Royal Garden; and the improvements since made in Italy, should be imitated. When the proper time shall have come, individual exertion will not need any encouragement for such expenses and such enterprises.

3d. The Society must always be ready to teach and to advise, respecting, as well the management of the mulberry trees, as the rearing of the silk-worms. They ought to endeavor to discover the prevailing errors and defects, and to remedy them. To that end, they should be on the lookout for every new publication on mulberry trees, and the cultivation and fabrication of silk; to be always at the height of the progress made in these several respects; and to adopt, accordingly, the most appropriate measures.

The Society will further be the channel of communication between the cultivators of silk and the Government, to be the more able to encourage everywhere the culture, to carry, wherever it is useful, information concerning its actual state, and to increase its advantages, as well in regard to the private interest of the cultivators, as to the interest of the community at large—the body politic. It behooves, of course, the Society to be the medium through which the *distribution* of the prizes and premiums are distributed, and of the sale of the cocoons, and of all that may be done for the advancement of the culture. Similar services may be expected from the Society, as has already been said respecting the fabrication, when the abundance of the cocoons shall give rise to it. The Board of Silk Culture of Munich may flatter themselves to have sedulously attended to these several objects; and the happy results which are obvious to the examiner of the actual state of the culture in Bavaria, will be still more evident with the progress of time, if the same activity continues to be displayed.

§ 94.

CONCLUSION.

When all that we have mentioned in the preceding § shall be accomplished, who will still question, whether the German nations can aim at seeing this important branch of culture and industry flourish among them, to the same degree as it has prospered in Italy and France? Who will deny, that, if such a happy result should be obtained, many millions will be saved to these nations? And, finally, who will still contend, that this new branch of industry is not proper to increase population, welfare, and public wealth?

000 Silk-Worms, from the time of their forth

ually enlarged.

newed.
ws are shut.
ate feeds in the preceding days, in consequence of the loss

he air of the laboratory must be renewed. Two more feeds.
must not be changed.

3d.
specti
ing of
vailin
should
and th
of the
ingly
Th
the c
encou
forma
as we
inter
cours
tion
coco
ture.
alrea
the c
nich
seve
amir
more
to be

W
acc
aim
amo
Fra
tain
will
inc

Representation

of the different ages of the Silk worm

B. Chambers Engraver

City of Washington

34
spec
ing o
vaili
shou
and t
of the
ingly
Th
the c
encou
forma
as we
intere
cours
tion o
cocoo
ture.
alrea
the c
nich
sever
amin
more
to be

W
acc
aim
amo
Fra
tain
will
inc

To Mr. P. Dodge
from N. Gilbert.

20th CONGRESS,
1st SESSION.

[175—Part 2.]

LETTER

FROM

JAMES MEASE,

TRANSMITTING

A TREATISE ON THE REARING OF SILKWORMS;

BY MR. (DE) HAZZI, OF MUNICH.

WITH PLATES, &c. &c.

APRIL 21, 1828.

Printed by order of the Senate of the United States.

WASHINGTON:

PRINTED BY DUFF GREEN.

1828.

SF
551
.H433

WASHINGTON, *February* 1, 1828.

SIR: I have the honor to present to Congress, through you, a Treatise on the rearing of Silkworms, by Count Von Hazzi, of Munich, who sent it to me for this purpose. The Count had seen the resolution of the House of Representatives, directing the compilation of a Manual on the Culture of Silk, and was desirous to promote the patriotic views of the House, by sending the result of his labors on the same subject, and as evidence of the good will he bears to the United States.

I have the honor to be,
Very respectfully,
JAMES MEASE.

The Hon. Mr. STEVENSON,
Speaker of the House of Representatives.

A TREATISE

ON

THE CULTURE OF SILK IN GERMANY,

AND ESPECIALLY IN BAVARIA:

OR

COMPLETE INSTRUCTION

FOR THE

Plantation and the Management of Mulberry Trees,

AND THE

REARING OF SILKWORMS.

BY THE COUNSELLOR OF STATE, DE HAZZI,

MEMBER OF SEVERAL AGRICULTURAL AND ECONOMICAL SOCIETIES, &c. &c. &c.

TRANSLATED FROM THE GERMAN.

INTRODUCTION.

Four years had scarcely elapsed, since the General Committee of the Agricultural Society of Bavaria had tried new experiments on the rearing of silkworms, and had published in the newspapers accounts of their success, when a strong disposition might be observed in Germany, to recommence, in several districts, the rearing of those insects, and to discover the old mulberry plantations. Similar efforts were made in other countries, and even in those the farthest north.

No twithstanding the many clear proofs of the success which attended, in Germany, that branch of industry, objections are made to it by a numerous party, who contend, not only that it can never prosper, but that it is altogether impracticable; and the whole scheme, according to their angry declamation, serves merely to deceive the kingdom, and to expose each individual engaged in the pursuit to the loss of his money, as well as of much valuable time and labor: "the rearing of the silkworm," they say, "having already been once tried, and abandoned from a conviction that it was a source of useless expense." It is, therefore, perhaps, high time to view this subject in the light of history and experience, in order to discover truth and detect error, whereby all doubt may be for ever removed.

We shall therefore speak, in the following pages,

I. Of the origin of the rearing of silkworms, in all countries.

II. Of the errors and blunders, which occasioned the neglect of this branch of industry in Germany, and particularly in Bavaria.

III. Of the best ways and means to introduce, to preserve, and to promote it.

Thus we furnish, as is announced by the title-page of the present volume, a treatise on the propagation of silkworms, to all German nations, and especially to the Bavarians; such a treatise having become the m ore indispensable to them, as an imperfect knowledge of the subject would expose them to old mistakes, and might paralyze the efforts now making to revive this highly important branch of industry. This purpose requires, after a clear exposition of all that has been said in relation to it in the classical Italian and French works of Dandolo and Bonafous, a comparative view of the experience acquired, in remote and more recent times, throughout Germany, and especially in Bavaria—of which latter I can speak as an eye-witness. Thus, we shall reach the highest point of perfection, which the rearing of silkworms has already attained in some countries: and from which, Germa-

ny can and must, therefore, derive some useful lessons. For, by observing the results of experiments, wherever made, upon the most extensive scale, and in the most approved methods, we shall be enabled to avoid reaching the summit of perfection, painfully and slowly, through a labyrinth of errors, blunders and half measures.

This treatise will, therefore, furnish all the information necessary to the rearing of silkworms, on a large or limited scale, in regard to the minutest details of that art, including the particulars of each daily task. Clergymen, schoolmasters, and all other constant observers of the process of rearing silkworms, and who will hereafter teach this branch of economy, and the fair sex, may derive, from this work, new means of improving it; and, lastly, statesmen may draw from it a perfect knowledge of the relations and interests arising from it in a political point of view.

DE HAZZI.

ON THE

CULTURE OF SILK IN GERMANY,

AND

ESPECIALLY IN BAVARIA.

SECTION I.

Of the origin of the art of rearing Silkworms in all Countries.

§ 1.

The history of the origin and developement or progress of every subject is of great importance, because every thing relating to it can then be shown concentrated, as it were, in a mirror, to be clearly seen, and correctly judged of.

§ 2.

The rearing of the silkworm owes its origin to the white mulberry tree, or to the caterpillar which feeds upon its leaves. This caterpillar is called *bombyx*, from the Greek word Βομβος, "a sound." The Greeks had two sorts of bombyces, and tissues of caterpillars. One of these silky substances, proceeding from a small species of hairy caterpillars, received the name of *koikos*, because it was obtained and manufactured in the Island of Cos or Coos, in the Grecian Archipelago, the birth place of Apollo and Hippocrates, now called Stanco. They denominated the other species of caterpillars the Asiatic bombyx, and its web was distinguished by the names of Syrian, Assyrian, or Asiatic, or *silk* proper.

§ 3.

The web of these caterpillars nearly resembles those of other caterpillars and insects; as, for instance, that of the great enemy of the pine forests of Germany, the Phalæna Bombyx Pini, and of the other species

of Phalæna, which nature has colonized upon ashes, oaks, palms, black poplars, &c. &c.*

§ 4.

The real silk or silk-web, was first known in ancient Serica, a part of the Chinese empire (perhaps the northerly part, beyond the 35th degree) and hence the Greeks called it Σηρικη, the Roman *Sericum*, the French *Soie*, the Italian *Seta*, and the English *Silk*. Forests of mulberry trees have been planted there by the hand of nature, and, for many centuries, mankind could have gathered from them the precious thread, and, as from the cotton, provided themselves with clothing, without much labor. But they remained long untouched, in a neglected and unprofitable state.

§ 5.

It was in the reign of the Emperor Hoang-ti, that a new epoch commenced in the culture of silk. The insects were sheltered, and carefully tended. The real rearing began, and was like the taming and employment of wild beasts for agricultural purposes. The history of China mentions, that 700 years before Abraham, 2,700 years before the Christian era, the Emperor Houng-Ti, "the Emperor of the Earth," who reigned for more than an hundred years, taught the Chinese to construct houses, carts, ships, mills, and other useful things of a similar kind, and persuaded, moreover, his first and legitimate consort, Si-ling-chi, to attend to the silkworms, and to try several experi-

* The silky substance produced by these insects is not entirely neglected in Asia. According to Du Halde there is an insect in the Chinese province of Shan Tung, which spins its silk in long threads on trees and shrubs, from which a stuff resembling linen, of a coarse but strong texture, and of a reddish color, is manufactured, and called Kien-tchon. It is now more than thirty years since experiments of this kind have been tried in Germany on such webs. We refer the reader to the "*Complete History of the advantages that might be derived from many plants hitherto neglected:*" by the late Professor Herzer: Regensburgh, 1794. This gentleman converted these webs into hats. About four years since, Lieutenant Sanson, of Munich, again called public attention to the tissues found on the German or black poplars. (populus nigra.) The General Committee of the Agricultural Society caused them to be collected in many English parks, and tried the experiment; which, however, failed of success. These webs could not be even used in the fabrication of coarse paper, and thus about two hundred weight of it is still lying profitless. The failure of this experiment may be attributed chiefly to the method of fabrication, to the imperfection of the cards, &c. The essays made by Lieutenant Hebenstriet, of Munich, with the wads of the lote trees and caterpillars, a species of moths found upon the spindle trees, upon vines and cherry trees, were still more important. He taught these insects to weave good wads for ladies' veils; (last year:) for an air balloon: and, still later, a dress woven in a nut shell, for the queen; in the following manner: He fastened some smooth shelves of lote wood, and (in default of this timber) of willow wood, in the form of a bridge, as high as possible, upon two or more lote trees, swarming with caterpillars, having first covered the shelves with bruised lote leaves, and moistened them frequently with a solution of lote salt; and upon these the caterpillars wove their webs. We refer the reader to a paper furnished by the Director Von Shrank, respecting this experiment, for the *Transactions of the Munich Academy of Science:* vol. vi. p. 69.

ments, in order to increase their utility; wishing, as he said, that his wife, the empress, might also contribute to the welfare of his subjects. The empress accordingly gathered the silkworms from the trees, and with the women attached to her household, endeavored to tend them with much care in the imperial apartments, to supply them abundantly with mulberry leaves, and to keep them very clean. It was soon discovered that they thrived more in rooms than in the open air, where they were constantly exposed to their natural enemies, serpents and spiders, and to the ill effects of changes of temperature; all which were obviated by subjecting them to domestic care. The cocoons gathered in the open air, and in the rooms, were also very different; the latter being not only more numerous, but of a better quality, and richer in silk. Care was afterwards taken that the eggs were hatched within the rooms; and there were thus two kinds of silk culture; the natural and the artificial; the superiority of the latter becoming gradually more and more manifest.

§ 6.

Similar exertions for the domestic culture, were made by the succeeding empresses, among whom the consort of the Augustus of China, Yao, principally distinguished herself. That art became thus the principal occupation of the empresses, and several apartments of the imperial palace were given up to it. From the highest rank of females, it came to be exercised by the whole fair sex, and obtained progressively such favor, that it turned to be the principal source of the wealth of China, which was from thence denominated "the inexhaustible storehouse of silk." The fair sovereigns of the empire did not, however, content themselves with the rearing of the worms, but attended, also, to the carding and weaving. The original promotress of that art in China, the empress Si-ling-chi, had already taught her women to convert the raw material into clothing stuffs, and to embroider them with representations of flowers and animals.

§ 7.

Soon, from the emperor down to the learned classes, the princes, courtiers and mandarins, and, in short, all who were in sufficiently affluent circumstances, were dressed in satin or damask. This greatly encouraged the rearing of worms, and the weaving and manufacturing of silk, especially as it occasioned a sumptuary regulation, which still continues to subsist, and marks the distinction of ranks among the Chinese: the higher classes having appropriated to themselves the exclusive privilege of wearing the silk stuffs, and assigned to the inferior orders cotton and cloth dresses.

§ 8.

Subsequently, silk became an article of exportation. From China it went into all the other countries of Asia, and afterwards to Europe.

The traders of Serica journeyed, at first, with the silken stuffs over the whole breadth of Asia. Two hundred and forty-three days were usually spent by the caravans, in going from the coasts of China to those of Syria. The prices they obtained far exceeded the expenses incurred; and thus the silken stuffs were found in every mart; but principally in Nisibis, in Mesopotamia, and among the most active traders in the world at that epoch, the Phœnicians, who at length carried them to the east of Europe.

§ 9.

The Greeks derived their first knowledge of silk from the military expeditions of Alexander into Persia and India; and Aristotle called to it the attention of his countrymen, as early as three hundred and fifty years before Christ. We have already related by what means the Romans obtained the silks. At first, on account of the high price of the silk, these stuffs had but the chains of silk, and the filling either of linen or cotton; or *vice versa*, and may therefore be called half-silk stuffs. Roman writers gave them distinct names. But a general outcry soon arose, even against the half-silk stuffs, under the pretence that they were too expensive and too womanish. Under the Emperor Tiberius, seventeen years after Christ, Haterius and Fronto declared themselves strongly upon this subject; and it was ordered "that no silk dress should henceforth degrade a Roman citizen." Even under Marcus Aurelius, in the year 173, such attire was only worn by ladies of the highest rank. The Syrian voluptuary, Heliogabalus, was the first who wore a dress wholly composed of silk, in the year 218, but in 270, A. D., Aurelianus denied to his wife, Severa, such a dress colored with purple. "Let us not," said he, "exchange gold for spiders' web:" and, indeed, at that epoch silk was of the same value with gold, weight for weight.

§ 10.

The silk trade increased, nevertheless, more and more in India, Persia, and Arabia; principally from the progress of luxury in eastern Europe, and the consequently greater demand for silk fabrics. No law could counteract such a propensity; and it was accordingly disregarded entirely in the eastern empire, under the reign of Justinian I. from 527 to 565. Through the intercession of the ill-advised empress Theodora, the wife of that emperor, a monopoly of the silk trade was granted to a broker of the name of Peter Bersames, who became afterwards chief of the imperial body guard. At this time, not only silk stuffs, but raw silk were imported from China, through Persia, and chiefly by way of Samarcanda and Bokhara, into the Phœnician cities of Tyre and Berytus, where silk was manufactured, and from whence it was afterwards conveyed into foreign countries. The monopoly granted to Bersames tended, however, to diminish greatly in those cities the profits of the silk manufacturers and traders.

The greater number of the former emigrated into Persia, and opened there workshops.

§ 11.

In the mean time, the demand for silks had prodigiously increased, along with the wealth and luxury of the Grecian court, of the inhabitants of the capitol, and other principal cities; and the Persians enriched themselves by carrying on that trade. This awakened the jealousy of the emperor Justinian, in regard to that branch of industry and commerce; and he determined to procure the same advantages to his own empire. His first step with this purpose, was to send an express embassy to the kings of Ethiopia and Abyssinia, to invite them to appropriate to themselves the silk trade, considering that they could obtain the silk direct from India, and had it in their power to send it to Alexandria through the Nile. The ambassadors explained the great advantages that would accrue from it; observing by way of argument, that Christian sovereigns ought not to permit the heathen enemies of the emperor to enrich themselves at the expense of his subjects. These suggestions had, however, not the least success, and the autocratic sovereign of the great Roman empire in the East, failed to procure to his subjects the silk-trade.

§ 12.

A mere chance produced what no exertion had been able to effect, and it gave a new face to every thing connected with that industry, and occasioned the production, fabrication, and trade of silk in Europe. Two monks presented themselves at the court of Constantinople, and offered to reveal the secrets of the rearing of silkworms, which they had learned during their missionary expedition in China. The Emperor, in his joyful surprise, made them rich presents: but it seems that the friars possessed only some seed of the mulberry tree, and considered themselves thereby completely provided, because they thought, that, when the trees should grow, the worm could not fail to accompany them, as in China. But this was a hasty conclusion; and the monks being encouraged, by the many splendid promises of the emperor, returned to China, in search of silkworms' eggs, though the exportation of them from that empire was punished with death. They got back to Constantinople in safety, towards the beginning of the year 555, and brought the precious eggs with them, concealed in their hollow pilgrims' staves. Nothing was now wanting to the success of the new industry. According to Byzantine authors, the eggs were hatched by heat of manure, as soon as the mulberry trees began to bear leaves, which served to feed the worms. In Greece, too, noble ladies were the first to attend to the rearing of the worms, with the assistance of their servants, and their children, and encouraged and extended the culture and the fabrication of silk throughout the whole country. Under Justin II, the successor of Justinian I, ambassadors

from Sogdiana declared, that the Grecian silk was, in no respect, inferior to that of China, and highly complimented the emperor upon his success. Silk, was at length, produced in such abundance, that the emperor Alexius, as it is related by his daughter Anna,* the historian, distributed in the year 1005, on the eve of a battle with the Scythians, among those of his soldiers whom he was unable to provide with armor, helmets and breastplates of iron colored silk.

§ 13.

At a later period, Spain and Portugal received from their Arabian conquerors, the art of fabricating silk. It was in 711, under the caliphs, that the Saracens conquered Spain; and they soon taught the inhabitants of that country to improve their agriculture, their manufactures, and their arts. "With the same vigor," observes professor Dresch, in his *Universal History*, "with the same earnest zeal with which they fought, for more than a century, they pursued the cultivation of science, under the auspices of the great caliph Haroun Al Raschid, the contemporary of Charles, and his son Al Mamun. These sovereigns regarded it as a maxim of policy, that the welfare of a nation consisted in its civilization. The Koran had classed agriculture, industry, and commerce, among the good deeds of the believer. Like the Roman Senators, who took their surnames from the plants which they had principally cultivated, (as, for instance, the Fabii and Lentuli,) the Arabian chieftains were fain to adopt, in the quiet of their private lives, names alluding to their skill in some manual industry; though, at that time, central and western Europe knew of no other pleasure than that derived from war, from wine, and from the chase. Charlemagne was the only sovereign who made any provision for the cultivation of the mind: but the benefits he conferred, terminated with his life; and from that time, the Arabian empire was the only seat of science, industry, and civilization. We owe them much in regard to agriculture; we are indebted to them for the manufacture of paper; for the expression of quantities by figures, and for many improvements in the art of dying: nay, our language bears numberless traces of the inventions transmitted to us by the Arabians. The historian and Bishop Otto de Freysingen, speaking of the great progress which silk manufactures had made in Spain, relates, that after the siege of Milan, Frederick I. held a diet of the empire, in 1158, in the fields of Roncaglia, at which were present, in magnificent attires, the ambassadors of the Genoese, who recently had conquered from the Saracens two important cities, Lisbon and Almeria, both famous on account of their manufactures of silk, and had made a rich booty. The later wars, and the defeat of the Saracens, might have been the cause that this species of industry did not pass the limits of the Spanish Peninsula, and fell partly into decay: for it cannot be doubted that the rest of Europe received it from Greece.

*Anna Comnena. See Gibbon, in regard to the merit of her history.—*The Translator.*

§ 14.

Greece remained a long time in the exclusive possession of the silk culture; and it seems that the Saracens were never acquainted with the breeding of the worms, and were only skilled in the art of manufacturing beautiful stuffs from the raw silk, which they received from the great emporium of Bagdad. The war of 1146, introduced that culture into Italy. According to historical authority, Roger I. the Norman king of Cicily and Naples, hearing that the great emperor Manuel Comnenus was negotiating an alliance against him, with Conrad III. of Germany, resolved to send an embassy to Constantinople, in the hope of obviating the danger which threatened his power, and to propose a matrimonial alliance with one of the daughters of the emperor; but Manuel threw the ambassadors into prison, and Roger, having accordingly collected his land and maritime forces, was so fortunate as to conquer successively Corfu, Cephalonia, Negropont, Corinth, Thebes, Athens, and several other cities and islands of Greece: from whence he carri ed with him into Sicily, an immense booty, and several thousand capti ves. Among the latter, were a great number of persons acquainted with the culture and fabrication of silk. Roger gave orders to treat them with much kindness, and persuaded them to settle in Palermo, offering them the most advantageous conditions. They introduced there their useful industry, and opened manufactures which soon acquired great celebrity; and from thence it was transmitted to the Calabrians, and at length propagated through the rest of the kingdom of Naples.

§ 15.

Sicily and Naples kept it mysteriously for a long time; and not earlier than in the sixteenth century, the mulberry tree and the breeding of the silkworms were introduced into the rest of Italy; and at first in Upper Italy. Emanuel Philibert, duke of Savoy and Piedmont, contributed the most to it; and those countries are also indebted to him for the introduction of the olive tree. From thence that new source of national wealth was transplanted into the Milanese, and the greatest part of Italy; and very soon that country became the principal seat of silk fabrication.

§ 16.

Its propagation through the other countries of Europe, was quite as slow. At first their inhabitants seemed to be satisfied with admiring and valuing the silk stuffs very highly. It was only in the year 1180, under the reign of Henry II. that such stuffs imported from China, began to astonish the English. At a later period, the Greeks supplied France and Germany with these products; which countries, in the middle ages received them from the manufactories of Italy. Charlemagne wore above his linen doublet and under-garment, a silk scarf round his waist. Not sooner than in the middle ages did the sumptuous silk cloaks, embroidered with gold and silver, worn by the knights over their more martial equipment, come into fashion. History mentions,

as examples of extraordinary splendor, that Henry III. assembled, at the marriage of his daughter with the king of Scotland, a thousand knights attired in silk. Charles VI. of France, in order to display his magnificence, wore, from the year 1422, constantly, a black velvet coat-of-arms, even in the hottest days. His successor, Charles VII. wore, at his entrance into Rouen, in 1449, a beaver lined with velvet, which was the most costly and elegant head ornament known at that time. In 1485, orders were issued in Germany against such expensive apparel; and females were expressly directed not to wear more than four costly dresses at the tournaments; and a whole suit of silk and gold was altogether prohibited to them. Even Charles V. took off his little velvet hat, at an inspection of his army, in 1547, to prevent it from being spoiled by the rain.

§ 17.

The silk stuffs still continued to be imported from the east and from Italy: but the first knitted silk stockings, which Henry II. wore, and which attracted extraordinary notice, came from Spain; and Henry VIII. as well as Edward VI. were likewise supplied from that country with the same article, for their personal use. No silk manufactures existed as yet in France or Germany; and not earlier than 1455, did females begin to spin and sew with silk in England; and in 1482, narrow stuffs and ribbands began to be manufactured from raw silk, imported from Italy. In 1521, silk weavers emigrated from Milan into France, where, likewise, some attempts were made to weave Italian silk; but all these were but partial experiments.

§ 18.

It was reserved to the great Henry IV. to introduce the culture of silk into France, at the beginning of the seventeenth century; and it constituted one of the splendid epochs in the history of that kingdom. Olivier de Serres was the most instrumental in this new acquisition, and the French call him, to this day, the patriarch of agriculture. In the year 1600, he published a book, entitled, "*Theatre d'Agriculture et Mesnage des Champs,*" by which light, as it were, succeeded darkness in rural economy; and it was read with so much eagerness, that thirteen editions were printed within a short space of time. This success, however, he chiefly ascribed to the excellent king, and to his wise minister Sully, who were the first to view agriculture in all its important relations, and gave to France the blessings of a golden age.* In sending to the king a copy of his work, Olivier wrote to him:

* From such impulses, the good king used to say, *that each peasant ought to have, daily, a chicken in his pot:* and hence the eager search after talented men and the favor shown to them; the facility with which Sully extinguished, in the space of ten years, the public debt of two hundred millions, that had been accumulated during the war; the surplus of thirty millions, which the Treasury possessed, ten years later; the general welfare throughout France; and, finally, the encomiums bestowed, to this day, upon the great monarch and his truly great minister.

"In presenting to your majesty *the Theatre of Agriculture and Management of Fields*, I do but call your attention to your own affairs." Delighted with the book, the king honored the author with a most obliging letter, written with his own hand, and desiring him to come to Paris. Olivier left, with great regret, his fine estate, in 1601; though he could not disregard a call which tended to make him more active for the good of his country. Scarcely arrived at Paris, he received the greatest distinctions: he soon became the confident and adviser of the king, and of Sully; and wise laws and regulations concerning agriculture were enacted. The king offered Olivier the highest honors—but he asked one favor only: that all useless trees might be banished from the royal gardens. When this was granted, Olivier went to work with such diligence, that, throughout the kingdom, the measure was executed within a short time. But this was not enough for his patriotic zeal: upon his recommendation, 14,000 mulberry trees, and a great quantity of seed of the same tree, were ordered from Italy, to supply the vacancies intentionally made in the royal gardens. In later times, he procured also, from Italy, silkworms' eggs, and persons acquainted with their rearing. The trees, the eggs, and a printed instruction, respecting their use, were distributed, *gratis*, to agriculturists; and the new industry was particularly recommended to the fair sex. Well, therefore, may Henry and Olivier be called the creators of the culture of silk in France.

§ 19.

The most singular feature of this innovation is, that the king did contribute more to its introduction, than any of his ministers. Him alone, was Olivier able to convince of its utility. He failed with Sully, who generally acted with great wisdom; but who, upon this occasion, was directly opposed to salutary advice. It is curious to find the following remark, at the conclusion of the 16th book of Sully's Memoirs:† "I shall not omit to mention here what was done in "France, in the year 1603, in regard to manufactures, and especially "those of silk. Henry, who embraced with ardor every means to "increase the welfare and glory of the kingdom, suffered himself to "be persuaded that nothing would be easier than, not only to become "independent of foreign countries in regard to the fabrication of such "silk stuffs as are imported into France, and which the French were "accustomed to procure from a distance, but to make them serve as an "important branch of the national trade. Nothing more was necessary for this, it was said, than to promote the rearing of silkworms, "the plantation of mulberry trees, and the building of houses appropriate for this species of manufacture. I was opposed to this project, "which could never please me; but the king had already taken a fancy "to it, and all that I said and could say was in vain." His objections,

† Memoires de Max, de Bethune, Duc de Sully, Londres, 1767, Vol. V. p. 74. This is altogether an interesting work, especially for German statesmen.

which he candidly states, related, however, not exclusively to silk manufactures, but were intended to check the growing luxury. "I dwelt," says he, with his characteristic candor, "upon this subject as much as "I could, to impress the more the king with my opinion; but I was "unable to convince him. 'Are these all the good reasons that you "can bring forward?' Henry said. 'I would rather beat the king of "Spain, in three regular battles, than be obliged to fight against all the "gentlemen of the gown, all the scribblers, and fine gentlemen, with "their wives and daughters, which you will raise against me by your "admirable regulations.' Your majesty is determined upon it, (quoth I,) "and I will say no more about the matter; but time and experience "will convince you that France is not made for trappings and finery."

§ 20.

How much would Sully now be astonished, could he behold the evidence of his mistake, and of the foresight of his royal master! Instead of continuing to pay to foreign merchants four millions of francs, annually, for silk, the French draw many millions from their ancient suppliers, and enrich themselves in proportion.

In subsequent times, and especially during the reign of Louis XIV., silk manufactures became so numerous, through the fostering protection of Colbert, that they have been, down to the present time, the most productive source of the wealth of France. The annual profits from this single branch of industry, in France, are estimated at forty millions of florins, of which a tenth is derived from the production of the raw material, and the remainder from the manufacture. According to the most recent statistical data, that kingdom derives, from the production of silk, in the twelve departments where it is attended to, 23,560,000 francs per annum, and 84,000,000 francs from the fabrication: and, consequently, the capital which is brought into circulation, in both ways, amounts to 107,560,000 francs.

§ 21.

England beheld, with no small degree of jealousy, the prodigious plantations of mulberry trees in France, the increasing production of silk, and the consequent multiplication of silk manufactures. James I. accordingly endeavored to introduce this industry into his own kingdom; and, in 1608, a most earnest appeal was made to the British public in regard to the advantages that might be derived from the plantation of mulberry trees: but nothing was done: and only as late as 1820, was this subject seriously taken up; some inconsiderable experiments having sufficiently established the fact, that these trees, and the precious insects which feed upon them, thrive as well in England as in France. But, long before that epoch, silk manufactures had flourished, to a considerable extent, in England—the raw silk being imported from Italy. There existed already, in 1629, so many of these establishments in London, that the weavers of the city and of the environs

were divided in corporations; and, in 1661, the individuals which composed them were more than 40,000 in number. The revocation of the edict of Nantz, in 1685, contributed greatly to the future progress of this industry—the most skilful French weavers having taken refuge in England. Next to this cause of the rapid progress of this manufacture, must be mentioned the silk machine erected at Derby, in 1719. The reputation of the English fabrics increased, at length, to such a degree that, even in Italy, as it is stated in Keysler's Travels, (vol. 1, p. 279,) English silk commanded a higher price than the Italian.

§ 22.

The history of the cultivation of silk, in Germany, divides itself naturally into three epochs; of which the two former may be called the unlucky. According to written documents, the first experiment on rearing the silkworm was made in 1598, at Rothenburg, on the Tauber, by Dr. Liebauf, and was continued for some length of time. It was repeated at Wurtzburg, Hochheim, Dresden, and Stutgard; but the results corresponded no where to the expectations to which it had given rise. Their proximity to Italy could not, however, fail to inspire the Bavarians with a desire of pursuing the same industry. They made, at first, some trifling attempt in that way, and, in 1669, a more serious one; a numerous company having been organized in that year, by individuals belonging to the most distinguished families of Munich, who made up a fund of several thousand florins. They entered into a contract with an Italian, by the name of Lucas Uffele, who engaged himself to supply them, for the space of ten years, with mulberry trees and silkworms' eggs from his own country, and to erect a laboratory upon the green, (at Munich,) in order that the breeding of the insects, as well as the fabrication of silk, might be carried on, at once, upon a great scale, and extended throughout the country. But the most immediate result was a long train of judicial proceedings against the Italian, who was thrown into prison, and only obtained his release, and a declaration of his innocence, after a confinement of six years and a half. We shall extract a remarkable passage from the decree issued upon this occasion, by the highest judicial authority, on the 14th of February, 1676: "Both parties (it is said) have reciprocally produced the heaviest charges of dishonesty and deceit: but the real cause of the ill success which has attended the enterprise, must be sought in the circumstance, that the company had spent so much money in unnecessary and too expensive buildings, that there remained but a few thousand florins for the accomplishment of the scheme: and finding themselves consequently unable to meet their engagements, the Italian merchants were compelled to sue them before the judicial authorities." After having experienced heavy losses, the company declared itself dissolved: and thus this great project resulted in a complete failure. After that time, no one seemed to have the courage to do any thing in that line.

§ 23.

A better spirit did not begin to awake in Germany until the middle of the last century: and we thus arrive at the second epoch in the history of the subject we treat of.

Frederick the Great, having chanced to see a silk manufactory at Torgau, during his military operations in Saxony, and having had his attention called to the descendants of some French manufacturers, who had emigrated from their country in consequence of the revocation of the edict of Nantz, and who had established themselves at Berlin, gave the first impulse to the regeneration of the silk culture in Germany. He ordered plantations of mulberry trees to be multiplied, extensive buildings to be erected, printed instructions on the management of the trees and the rearing of the silkworm to be distributed gratis; and he promised considerable bounties to those who would devote themselves to that industry. According to a detailed account,* the quantity of silk collected in the provinces of Magdeburgh, Halberstadt, Brandenburgh, and Pomerania, amounted to 6,849 pounds. From 1744 to 1755, 35,678 mulberry trees were planted in Saxony, which, in 1753, produced 150 pounds of silk. Similar success attended the endeavors which were made in the county of Hanau, in Wurtemberg, Anspach, and Baireuth, and on the estates of Prince Lichtentein, in Austria. But the most active promoter was the Elector Charles Theodore in the Palatinate, where, under his auspices, 80,000 mulberry trees were planted; and his example was soon followed in the duchy of Deux-Points, and in that neighborhood. Encouraged, at first, by the bounties offered, and afterwards being expressly commanded, the peasants devoted themselves to the new industry, and much was done to ensure its ultimate success. Charles Theodore, brought, in 1777, into Bavaria, the same favorable disposition which he had evinced in the Palatinate. A special silk Superintendency was erected by an ordinance, which bears date of the 20th of December, 1781, and whose residence was fixed in the capital of the Electorate. By another edict of the 26th January, 1783, that Department received further organization, in consequence of which it bore afterwards the name of General Silk Superintendency, with an assignation of 6,000 florins upon the Treasury; which was, however, considerably increased in later times. A company was also incorporated, by which extensive plantations of mulberry trees were soon made at Munich, Landshut, Engelkofen, and Arnsdorf, at some later time at Straubing and Burkhausen, and the promenades, ramparts, and streets of many cities were ornamented with these trees; buildings were erected, officers appointed, silk manufactures multiplied, and much money expended in that way. But, to the great satisfaction of foreign traders, this second epoch, which had commenced under the most favorable auspices, ended soon, as unfortunately as the former, though the national industry had been encouraged by high duties upon foreign

* V. Threber's Collecta, a German periodical, 1755.

imports. An edict, dated June 20, 1787, considerably abridged the power of the General Superintendency, which was at length entirely abolished. The company was dissolved, after a loss of several thousand florins; the mulberry gardens were neglected, and, in process of time, the trees which ornamented the streets, terraces, and promenades, were cut down; and the inhabitants of Germany seemed to rival each other in characterizing, in this manner, the termination of the second epoch in the history of the silk culture among them.

§ 24.

"It might have been expected," says the above-mentioned writer, "that so extensive a plantation of mulberry trees, the number of which amounted to one million, would have enabled Germany to leave off the importation of silk from any foreign country. But whilst the fabrication of it made rapid progress in France and Italy, every establishment of the same kind declined in Germany. At length, the wars arising from the French Revolution completed that unfortunate state of things: no mulberry tree was left upon the German soil; and the culture of silk was so much neglected among its inhabitants, that hardly any sign of it remained."

§ 25.

This is the more to be regretted, as the use of silk, instead of diminishing, has greatly augmented, and to such a degree, that, from the most fashionable ladies, down to the lowest female servant, each wears some silk article: and the interior of houses, churches, and palaces, shines with silk drapery. How much Germany pays for this single commodity to foreign countries, may be estimated from the following statement of the sums expended by Bavaria alone:

GENERAL STATEMENT of the quantities of silk imported into Bavaria, presented by the King's Minister to the States General of the Kingdom, during their late session.

Years.	Qualities of Silk.	Quantities.	Value.	
			In part.	In toto.
		Cwt.	*Florins.*	*Florins.*
1820, '21	Raw silk	9	100	900
	Carded silk	30	150	4,500
	Spun silk	409	250	101,250
	Silk stuff	1,850	2,080	3,700,000
				3,806,650

It must be observed that this importation of one single year, can only be considered as a minimum; as, on the one hand, the smuggling trade, which is considerable, is not brought into account; and, on the other hand, the official valuations are rather low: for the ordinary prices are (taking them at their most moderate rate) as follows:

Raw silk,	1	pound	1 florin
Carded silk	1		10
Spun silk	1		14
Silk stuff	1		34

Whence it appears that the quantities mentioned in the *General Statement* have really cost

Florins.
900
30,000
571,000
6,290,000
6,891,900

Bavaria pays thus, taking but the minimum of imports, from six to seven millions of florins, annually, to foreigners, as a tribute for the use of silk. But it really amounts to eight or nine millions: and from these data, each German State may calculate the amount of its own losses from the same cause.

§ 26.

An accident brought about the third and most recent epoch, which began with the year 1821. During the distribution of premiums, at the agricultural solemnities of that year, in the circle of the Lower Danube, high praise was given to the exertions which had been made for the revival of the silk culture, by a noble lady, by name of Leeb Straubing. My own attention was thereby strangely kindled, and I remember that on my entrance into public life, as Aulic Counsellor, I heard much in the Council of silk culture, and that we had a good deal of trouble with the silk buildings and silk manufacture; whilst, at that time, there was hardly a mulberry tree in the whole neighborhood of Munich. Upon this, I requested Mr. de Nagel, Secretary of the General Committee of the Agricultural Society, and who had become acquainted with the culture of silk in Hungary, to draw up a memorandum respecting the mulberry tree: and I stimulated him by the following remarks, which I caused to be inserted in the weekly paper of our Society: "More information is desired, especially as to the question from what circumstances the plantations of mulberry trees, and the silk manufactures, which were established in Munich, Landshut, &c. under the Elector Charles Theodore, at so much expense, have fallen into decay; and by what means the difficulties arising from the climate could be removed: and finally, whether no

private plantation or establishment of the kind still remains in Bavaria? This important subject ought to be considered, under all its aspects; and much useful intelligence may be expected from such a discussion."

These suggestions did not remain without effect, especially as I took care that a diligent search should be made among the oldest documents deposited in our archives; and I directed Mr. de Nagel to enter into correspondence with the above-mentioned lady, and to converse upon the subject with the officers of the late Superintendency. Much information was thereby obtained. With fifty silkworms' eggs, furnished by Lady Leeb, the first experiment was made in the spring of 1822, under the direction of the General Committee of the Agricultural Society. Fortunately three mulberry trees were discovered not far from the capital. Within 44 days we were in possession of 50 beautiful cocoons, and the butterflies, into which they were metamorphosed, produced 2,500 eggs. These were hatched in the spring of 1823, at which period more mulberry trees had been discovered. In 1823, the number of silkworms' eggs, of which we could dispose, amounted to 600,000, which were offered to be distributed to all persons who should be willing to devote themselves to the culture of silk, and who should discover some mulberry trees near their residences. This measure was crowned with the desired success. Demands for eggs, and directions for their use, reached us from several parts of the kingdom, and in the process of time a still greater number of mulberry trees was discovered. We were informed, at the same time, how madly whole alleys of the precious trees had been cut down, even very recently, to serve for fuel like the commonest wood.

§ 27.

When it was known, in 1823, that a merchant by name of Spohrer, and the silk manufacturer, Mr. Wurtz, were engaged in the silk culture, the committee requested Captain Grouner* and Lieutenant Sanson to inspect those establishments; and the information thus obtained, confirmed the fact, that these private enterprises were very expensive; whilst, on the contrary, the experiments made by the committee had not cost any money. They fixed, however, the attention of the king; and when Mr. Spohrer presented to His Majesty a suit made of his silk, gold medals were presented to him, as well as to Mr. Wurtz. It became now a matter of serious deliberation, how mulberry trees could be procured for those who manifested an intention of attending to the business. At length, Captain Grouner and Lieutenant Sanson proposed to form a general fund, by means of private contributions. The sum obtained in this manner, amounted to 880 florins 48 kr.

* This worthy gentleman, who had rendered distinguished services to agriculture, and was one of the founders of the Agricultural Society, died shortly after the event mentioned in the text.

§ 28.

Such is the origin of the Board of Silk Culture, which was created on the 14th of March, 1824. An extract from the Journal of the Board will sufficiently elucidate its object and fundamental principles.

*"New Board for the extension of the culture of Silk, near the General Committee of the Agricultural Society of Bavaria."**

"To-day, March 14th, 1824, assembled the elected members for the new Board, which, in conformity to the resolutions adopted by the General Committee of the Agricultural Society, on the 11th of February, is to be organized in the same way as the Board for Agriculture and for the improvement of the country. After the reading of the resolutions and the list of the members of the new Board, the Counsellor of State, Mr. de Hazzi, spoke in the following terms:

"*Gentlemen:* The resolutions which have just been read, explain the end for which you are convened. It is not less than to procure to your country an important branch of production and industry, known by the name of culture of silk. "That industry has already once existed: your exertions will be vain: it could not prosper in past times; our climate is contrary to such an enterprise." Such are the objections I am prepared to hear from our adversaries; but we must take care not to be misled by such arguments; for this, like every other useful undertaking, must fight its way before it can obtain an adoption. Silk culture has had the same fate in all countries."

[I introduced here an abridgement of the historical account contained in the present work, and after this, I went on saying:]

"What is, after all, our purpose? To profit by the experience of the world, and to avoid the errors that have been committed at other times. Like the Greeks, Italians, and French, we wish to call into existence the culture of silk. Let, therefore, our motto be: *no Board connected with the Government, no particular administration, no public officers, no expenses: the culture of silk shall be an affair wholly belonging to the people: an incidental business, the secondary work of servants, children, paupers, and old people.* Encouraged by the example of Greece, Italy, and France, we wish to trust it to the fair hands of ladies, who could, by way of amusement, and without any expense, obtain, within six weeks, a most elegant material for the ornament of their persons and of their apartments.

"The whole enterprise requires nothing further than to feed the silkworms in the spring with mulberry leaves; a care not greater, but surely more useful, than the feeding of dogs, birds, and cats; to keep them clean, and to grant them a little space in a room to spin their silk. These are the means by which the cocoons are obtained, and these furnish again eggs: and here ends the whole culture: for the cocoons themselves are articles of commerce.

* The reader is referred to the weekly paper of the Agricultural Society for the fourteenth year of their proceedings. P. 423, 424.

"What will then be the business of the Board? It is very simple, and is reduced for the present—I. to attend to the plantation of mulberry trees; II. to procure silkworms; III. and lastly, to guide in the use of these means. Only after these three preliminaries have been attended to, begins the last chapter of fabrication. For the first step must be to produce the substance fit to be sold, before the fabrication can be thought of; and even for this latter object, some preparatory measures have already been taken.

"We shall now say a few words upon each of these three heads, under which we have ranged the whole subject.

"I. The plantation of mulberry trees must, in the first place, receive our attention. We owe to the liberality of the king, and to some voluntary contributions, the means we already possess of beginning such a plantation. We expect, to-day, the trees, cuttings, and seed. But we must take care to avoid the errors and blunders of yore; and not ascribe it to the climate, if the trees should not thrive. The climate has nothing to do with it: for the mulberry tree has resisted the temperature of Russia and Sweden; and we find them to this day in Germany, wherever they had been planted with any sagacity.

"We are at last convinced of a fact which had been too much overlooked; namely, that the worms do not come out from the eggs before the mulberry leaves have begun to shoot. They would otherwise die, as soon as they began to live. The principal blunder in the old plantations was, that no appropriate selection was made; whereas the *white* mulberry tree serves alone for the rearing of silkworms. Not all white mulberry trees are, moreover, equally good. They must not be planted separate along the street, exposed to the dust, or to northerly winds, nor in a marshy soil; but, on the contrary, in sheltered places, with an exposure to the sun. Care must also be taken, that the trees shall not remain entirely leafless,* because leaves hold the same in relation to plants and trees, as the lungs to the bodies of men and animals. A leafless tree dies soon: not more than half of its leaves, or, to the uttermost, two-thirds of them, should be stripped. Finally, hedges procured from the seed, may supply the place of standard trees: for they are, after three years, as abundantly covered with leaves.

"II. Much depends, also, on the choice of the worms; and the quality of the silk follows pretty closely that of the insects; at present we may content ourselves with those we have; but in future, we must endeavor to procure the finest species from Italy and Spain. More instruction will be found, on this topic, in the brief treatise drawn up by the General Committee of the Agricultural Society, and which may be had gratis. Silkworms' eggs, will, meanwhile, be distributed also gratis, in proportion to the number of old mulberry trees that may be discovered.

"III. In regard to the feeding of the worms, the cleanliness they require, and other details of their procreation and preservation, we refer to the above-mentioned treatise. I will only mention here, that

* Bonafous is not of this opinion. See hereafter, § 56.

dry leaves, free from dust, are to be daily distributed. The leaves that fall from the tree belong to him who gathers them; and the trees should, therefore, be planted in open places, such as church and school yards; and the Board is aware that the most economical part of the business will long need their protection and advice.

"But, if once the three following preliminary conditions are obtained, namely—1st. that mulberry trees be planted for the use of every body; 2d. that the best species of silkworms be distributed, without any remuneration, to all persons who wish to have some; and, 3d. that the public becomes convinced, that, without the smallest expense to the State, any individual who desires, may draw from naught a considerable gain—who will blame us, then, if we hope to see, within a few years, the culture of silk extended throughout Bavaria, and this country enjoying the same advantages which were ensured to France by Olivier, who is deservedly ranked among the great men and benefactors of that kingdom? We can trust the more to these expectations, as they are warranted by some practical and successful experiments made in Bavaria, some years since. Let us begin, therefore, our task with much confidence: let us promote this important branch of agriculture and industry, by all the means we possess; and let us remove the difficulties which still embarrass its revival. When we shall have done so, our country will be indebted to us for an important improvement, and we shall have obtained the reward most worthy of our exertions."

After I had finished my observations, the society proceeded to the election of the members of which the new Board was to be composed.

I was elected President, Mr. Counsellor Wepfer was appointed Secretary, and Lieutenant Sanson Deputy Secretary.

The other members of the Board were:

Mr. de Skell, *Inspector of the Royal Gardens.*
Mr. Sterler, *Botanist at Nymphenburg.*
Mr. Seitz, *Gardener in the King's service.*
Mr. Hailer, *Id.*
Mr. Hinkert, *Id.*
Mr. Zischl, *Architect.*
Mr. Vogel, *Manufacturer.*
Mr. de Maffei, *Merchant.*
Mr. Zottmayr, *Dyer.*
Mr. Wurtz, *Silk Manufacturer.*

The pecuniary affairs of the Board are managed in the ordinary manner, by the General Committee of the Agricultural Society. Resolutions were immediately adopted to require the subscribers to pay the amount of their subscriptions, that the Board might be enabled to pay the price of the twelve hundred mulberry trees, which were expected on that day. It was further resolved, that they should be distributed to those who already had made applications for them; and that the remaining trees should be given, gratis, to all persons willing to plant them; that silkworms' eggs should be distributed at the

same time; and that both these gifts should be granted unclogged with any conditions, as it is expected that they would be employed to the end for which they were requested.

To prevent, however, the blunders which might be committed in the plantations, and the disgrace which might thence fall upon the whole scheme, the two gardeners attached to the Royal Parks, Messrs. Hinkert and Seitz, have volunteered to inspect and direct as well the plantations as the future management of the trees; each of these gentlemen in one section of the neighborhood of the capital, which was divided for that purpose into two sections—the northern and southern. We are inclined to think that this example will be followed in the several departments of the kingdom.

The principal object of the meeting being accomplished, the Board adjourned.

§ 29.

The trees, the cuttings, and the seed, that had been received from Italy, Hungary, and Manheim, and the eggs and the mulberry seed, ordered from Italy, were speedily sent in all directions, together with the printed instruction, and Mr. Nagle's above-mentioned memoir.* Fortunately, in a great many places old mulberry trees were discovered, and sixty-nine in the neighborhood of Munich alone. In this way was the third experiment tried in the present year. More particulars are contained in the following advertisement, inserted in the Weekly Journal of the Agricultural Society, (Year 15, No. 7.)

"*Present state of the culture of Silk in Bavaria.*

"It appears from the statements laid before the Board of the Culture of Silk, in their session on the 19th of September, 1824—

"1st. That the exertions in this branch of industry, have increased to a wonderful degree; that mulberry trees have multiplied in all directions; and that more seed and silkworms' eggs have been ordered for the ensuing spring, (1825,) though the existing plantations could furnish a sufficient quantity of cuttings—the trees imported from Italy, Hungary, and the banks of the Rhine, having perfectly succeeded, as well as the plants derived from the seeds.

"II. That a great number of mulberry trees have been found in many districts of the kingdom, and fortunately saved from the axe, after thousands of them had been felled, through sheer ignorance. Upwards of one hundred thousand had been cut down in one single district, called the Regens Kreis.

"III. That the intelligence procured in different parts of the kingdom, and the facts which may be collected from a survey of the scene under the more immediate control of the Agricultural Society, as well as the present manufacture of Mr. Wurtz, prove that the silkworms

* Theoretic and Practical Instructions for the Culture of Silk in Bavaria. Munich, 1824.

have withstood all the changes of climate, even when not tended at all, as was the case in the dwelling house of the Agricultural Society; and that neither diseases nor mortality have occurred, though the season was very unfavorable, and that the worms had grown to maturity, and had spun their silk.

"It is therefore demonstrated that ovens and close covers, during a thunder-storm are unnecessary; that the insects bear every temperature, and every clime; and that they need nothing but clean and dry mulberry leaves.

"IV. That many thousands of very handsome cocoons have been sent from all parts, and that the silk is not inferior to that of Italy. The Board of Silk Culture have resolved, that this silk should be manufactured by Mr. Wurtz, and that the products, such as stockings, handkerchiefs, ribbons, &c. &c , should be distributed gratis, by way of encouragement to those who had furnished the cocoons."

§ 30.

Greater exertions were made in Bavaria, in the course of the year 1825. A great quantity of mulberry trees, seeds, and worms, and a portable spinning machine, were procured from Italy and Hungary. The official statement in the weekly Journal of the Agricultural Society, was in these words:

"*Silk culture in Bavaria*, 1825.

"In the session of the Board for the Cultivation of Silk, on the 21st of August, the manufactured articles, such as scarfs, ribbons, &c. &c. were distributed gratis, as a reward and encouragement of the silk-growers, in proportion to the number of cocoons they had furnished. The Board examined afterwards the results of the culture, within the walls of their own building; and it was ascertained, that, notwithstanding the unfavorable weather, the worms had safely passed through all their changes, and produced, at length, the most beautiful yellow and white cocoons.

"The mulberry trees received from Italy, Hungary, and the banks of the Rhine, have all succeeded. The several thousand two-year-old seedlings, and the planted branches, present the same satisfactory result. The mulberry seeds received from Trent had produced plants one foot in height. The seed received from Turin was less successful; and, upon the whole, it is remarkable, that neither the trees nor the seed have suffered at all from the raw weather we had during the spring, whilst, on the contrary, many forest trees were damaged.

"In order to ascertain more exactly the actual state of the culture of silk in Bavaria, all those who had received mulberry trees, seed, and silkworm's eggs, were invited to send to the General Committee of the Agricultural Society a detailed report. It must not be forgotten, that the Board pays a florin for each pound of faultless cocoons; provided that a certificate, from a competent authority, be exhibited,

stating that it had been obtained from native mulberry trees, and reared in the country. It was, at the same time, made known to all those who might wish to obtain for the ensuing year, either mulberry trees, or seed, or eggs, that they ought to make their applications before the end of the present year, whereupon their request would be attended to, gratis, in the course of the next spring.

"Upon this, numerous applications of the kind were made; and more old mulberry trees were discovered, in several parts of the kingdom. The demands proceeded from public officers, magistrates, school inspectors, clergymen, schoolmasters, merchants, and agriculturists. It was, therefore, necessary to procure several thousand of mulberry trees, and seed, and eggs, in order to meet the demand; and it was really cheering to observe the zeal which had thus been rekindled within so short a space of time."

§ 31.

The great progress which the cultivation of silk made in Bavaria, attracted the attention of several German States, viz: the kingdom of Wurtemburg, the Grand Duchy of Baden, the Electorate of Hessen, Nassau, Meinungen, &c. &c. In Prussia, the exertions were the greatest; and the newspapers of Berlin, of 1825, contain the following article, which is too important to every German to be omitted in the present treatise: "That the cultivation of silk can be pursued in the greatest part of the kingdom, or, more correctly speaking, in all parts of it, where the mulberry tree thrives, with the same advantages, in regard as well to the quality and the quantity of silk, as to the expenses and the profits, as in the Milanese and in Piedmont, where it has existed only for three centuries back, is sufficiently demonstrated by the experiment tried, upon a considerable scale, in the present year (1825) by the print-seller, A. W. Bolzani. Through the intercession of the superior authorities, some rooms were given up to him, for that enterprise, in the Hôtel of Invalids. He had rented the trees from the responsible agent of this house and the hospital; but it was previously indispensable to have them regularly stripped of their foliage, whereby he was, indeed, sure to have a greater quantity of leaves in the following year, but did not escape for the present, the inconvenience of procuring, at a considerable expense, a provision of them from Kopenik; and, as if the scheme had been doomed to undergo, from the beginning, the severest trials, the weather was unusually rainy, and continued so during the whole season of culture, viz: May and June. But he overcame all these difficulties, as well as those arising from the circumstance that the scheme was entirely new in this city. He produced upwards of a thousand pounds of extremely well spun cocoons, and will thus have, at the rate of the previous experiments, a hundred pound of fine silk, which will not be inferior to the finest of Upper Italy. This is, it is believed, the greatest profit derived from a private enterprise. Bolzani has shown himself, in this undertaking, not only a man proficient in all the proceedings long known, but also

The Times of the 4th of October, 1825, contained the advertisement, published under date of the 29th of the preceding month, by the company incorporated by Royal Charter, under the name of "British, Irish, and Colonial Silk Company, with a capital of one million pounds sterling, in shares of £50." The most distinguished statesmen, noblemen, and members of Parliament, as well as the richest bankers of Great Britain, are among the Patrons, Presidents, Directors, and Officers of this Corporation: as, for instance, the Marquis of Lansdowne, the Earl of Liverpool, the Attorney Generals for England and for Ireland, the Marquises of Salisbury and of Downshire, and Messrs. Brougham, and Walker. The Company's object, is the cultivation of silk in Great Britain and Ireland,† and the British Colonies, with the exception of the possessions which are under the control of the East India Company, the purchase and introduction of foreign silk, and the construction of silk spinning machines throughout the British empire: and, to that end, extensive plantations of young mulberry trees have been made in England and Ireland, partly by importations from abroad. Mr. Abbott, the Secretary of the Company, mentions, at the conclusion of the advertisement, that 50,000 applications for shares had already been received, and he requests those whomight be willing to decline the business, to make it known to him before the 10th of October.

The new impulse thus given to the culture of silk, was not without effect in those countries where it already existed. Thus Mr. Camille Beauvais, in the House of Deputies of France, during their session of 1825, called the attention of his countrymen to the introduction of that industry in Great Britain, and the advantages which the English had already gained over France, in regard to the fabrication of silk. "Instead of ten thousand silk looms," said he, "which existed in England ten years since, there are now 30,000; and the weaving of ribbons in the manufactories of Coventry, has increased in the same ratio. In preceding times, the English drew the silk stuffs from Lyons; but at present, they not only import no more, but successfully compete with the manufactories of Barcelona, Valencia, Sevilla, and Grenada, in the South American markets. They import the silk from East India, though it is of an inferior quality to the silk of Milan and Piedmont. Mr. Beauvais showed how desirable it was that mulberry trees should be planted, and silkworms reared, in the northern department of France, and principally of the kind that produced white silk. He further observed, that the French silk products still excelled the English in color and texture, but that the latter had an advantage in their machinery, which enables them to sell at a lower price; but that the most striking fact was, that the manufactory lately begun in Switzerland, Italy, and on the Rhine, (principally) at Elberfeld, almost rendered the superiority of the French doubtful.

† It is stated in an article from Ireland, under date of the 12th February, 1826, that on that day a vessel had arrived from Cette, (in the south of France,) with 26,000 mulberry trees, which the Silk Company had ordered for a first experiment in Ireland.

In Austria, also, the cultivation of silk has grown into favor. The Vienna Court Gazette, of the 7th September, 1825, contains the following communication: "The Imperial and Royal Agricultural Society at Vienna, has awarded to the memoir of Mr. Heintl, on the prize question relative to '*The production of provender, in Austria, below the Ens,*' independent of the honorary medal, a premium of fifty ducats, which he has divided into new prizes, for the encouragement of the cultivation of silk; requesting the society to keep the money as well as the medal, to publish the object of the premium, and to distribute the prizes in due time. Persuaded of the importance of the proposed culture, principally under the circumstances in which the agriculturists find themselves at present in the dominions of his Imperial and Royal Majesty, the Society has accepted the offer of the honorable member, with the eulogium it deserved, and authorized the standing committee to issue the following notice: I. Thirty ducats in gold, and the silver medal, will be awarded as a prize and encouragement to any inhabitant of the territories of his Imperial and Royal Majesty, who, in any part thereof, where, in a circumference of three miles the silk is not already cultivated, shall have produced, in rooms and after the usual method, at least ten pounds of clean marketable silk, within each of the two years 1826 and 1827. Should there be more than one exhibiter, the preference will be given to him who shall have produced the greatest quantity of silk. II. Twenty ducats and the silver medal of the Society, will be adjudged as premium and reward to any inhabitant of the territories of his Imperial and Royal Majesty, who shall have obtained, in the course of the year 1827, at least one pound of clean silk, in the open air, from silk-worms which had spun their silken habitation, when in the state of aureliæ, rent their coverings, coupled, and deposited their eggs upon the trees. Should there be several competitors for the prize, the preference will be given to the person who shall furnish the greatest quantity of silk. As there are many mulberry trees in the territories of his Imperial and Royal Majesty, the culture of silk ought not to be neglected. Mr. de Heintl describes in his memoir, entitled '*Means of pursuing the Culture of Silk in the open air, and of connecting it advantageously with the usual rearing of Silkworms in rooms,*' the experiments instituted in the open air, under the direction of the War Department, by the regiments stationed on the frontiers. The principal conditions for obtaining the above-mentioned prizes are— 1. That the silk must have been produced within the Imperial and Royal dominions, by worms fed upon trees planted within the same. No difference will be made on account either of the province, place of birth, rank, or sex of the person who contends for the prize, and even foreigners may obtain it, if the silk has been obtained under the abovementioned circumstances. 2. The silk thus exhibited, remains the private property of the exhibiter, and the sample need only to be sent to the Society, free of expense, and accompanied with a detailed account of the process of culture employed in its production, and a written reply to the question, '*Whether in the country where the exhibiter resides, the culture of silk had not been pursued since the memory*

of man, or how long since it has been discontinued?' The candidate for the prize must also obtain a certificate of the civil or military authorities, stating the quantity of silk produced by him, and testifying that all the prescribed conditions have been fulfilled: and these papers and the sample must be delivered in Vienna, at latest at the end of November, 1827, in order that the prizes may be awarded according to the report made thereupon by the standing committee of the Society, at the next general meeting. The persons entitled to the prizes, shall be made known through the newspapers, and the money as well as the medal will be sent to them.

"COUNT JOSEPH CHARLES DIETRICHTEIN,
President pro tem.
BARON CHARLES DE BRAUN,
Perpetual Secretary.

"VIENNA, *September 1st*, 1825."

§ 34.

It cannot, therefore, be denied, that there is an unusual disposition to introduce the culture of silk into countries where it previously never existed, and to revive it where the culture as well as the fabrication have once flourished, and to carry both to a higher degree of perfection; and, finally, it is of urgent importance to investigate the causes of the success which has hitherto attended this industry, in several countries, with a view of proceeding upon better principles, and to avoid the waste of time and of money which would result from a repetition of exploded errors.

SECTION II.

Of the errors and mistakes which occasioned the decay of the Silk culture in Germany, and especially in Bavaria.

§ 35.

In the Austrian dominions silk is cultivated in Tyrol, Lombardy, Illyria, Dalmatia, and a part of Hungary; and that government strives to introduce it also in the other provinces, with a view of saving the many millions of florins which go abroad for stuffs of that material. The following letter of the Baron de Stainlein, Bavarian Envoy to the Imperial Court, who is acquainted with the subject, and has an estate in Hungary, will throw light upon this part of our subject:

"VIENNA, *February* 25, 1825.

"*To the General Committee:*

"I cannot better reply to your letter, of the 8th of the present month, than by communicating to you the Chevalier de Heintl's

'*Remarks on the Cultivation of Silk in the open air,*' &c. &c.: Vienna, 1815: which contain a full history of that culture in Hungary.

"The cultivation of mulberry trees and of silk, in the Austrian dominions, is under the following regulations: By the ordinances of the 12th of April, 1782, and of 6th of April, 1786, a few hundred florins are appropriated, yearly, to the encouragement of the silk culture in Bohemia, which are distributed in prizes to the commonalties which can prove, at the end of each year, that they have planted the greatest number of mulberry trees, and have entered upon the silk culture with some success. By an edict of the 5th of January, 1795, and an ordinance of 23d of February, 1804, it is enacted, that, considering the well ascertained fact that the Italian silk is inferior to that of Bohemia in neatness and strength, and that the inexperience of the cultivators, and not the climate, had been the true reason of the small progress which that culture had as yet made, the competent authorities shall encourage the agricultural corporations not only to provide lands and buildings, but to give the example of reviving this somewhat laborious but profitable industry, and to engage the inhabitants, by all the means in their power, in the pursuit of it; and to warrant to them the purchase of their products by the manufactures of Vienna, who, indeed, earnestly wish to be supplied with native silk. The authorities of the several circles are directed to make known, every year, all persons who have distinguished themselves most in that line; whereupon rewards shall be distributed to them, and the weight of the cocoons that may be brought upon the market; to the end that the government may be enabled to call together a great number of purchasers, and to ensure, thereby, to the cultivators, the greatest advantages from their exertions.

"On the 3d of December, the government addressed to the directors of the respective circles a circular letter, in which it is said that the anterior regulations had not answered their expectations—the silk culture having gradually fallen into greater decay; and that the several authorities had contented themselves to state, briefly, in their annual reports, that no mulberry trees had been planted, on account of the climate and the prevailing prejudices. Persuaded that neither positive orders nor compulsory measures would produce the desired result, the government was satisfied with recalling public attention to the regulation issued on the 23d of February.

"The government communicated on the 4th August, 1814, to the dominial authorities, information received from a merchant of Prague, by the name of Ranghieri, respecting the progress which the cultivation of mulberry trees and silk had made under his direction during the late year, in that city, and recommending to the said authorities a work published by the same individual upon this subject. An ordinance of the 3d of November, 1815, confirms those that had been previously issued in regard to the slow progress of this culture, and makes it incumbent upon the public authorities to attend, at least to the preservation of the existing mulberry plantations, and to contribute, as far as

might depend upon them, to the multiplication of these trees on the streets, public squares, &c.

"No where does the culture flourish so much, in the whole Austrian dominions, as in the Bannat of Temesvar, where, however, it is pursued at the costs* of the government, and by no private individual; which may, perhaps, be ascribed to the manifold details of that laborious enterprise, and to the comparative insufficiency of the population.

"I must not, however, omit to mention that the culture of silk has long since been pursued successfully in Bavaria, by the Rev. Mr. Mayer, of Himmelskron, near Kulmbach, in the Circle of Upper Main; and this gentleman will undoubtedly find great pleasure in communicating to the Committee the remarks which his personal experience may suggest for the promotion of this branch of industry.

"BARON DE STAINLEIN."

§ 36.

Mr. Heintl's endeavors to introduce the culture of silk in the open air, had no better success, as might have been foreseen: for they tended to undo what the empresses of China had so successfully obtained by sheltering and feeding these insects in apartments provided for that purpose. If that culture be still pursued in China in the open air, the difference of circumstances between that empire and Europe is obvious, and the housed silkworm is not employed in that culture. How, then, could this insect be so employed in the colder atmosphere of Germany? The exertions of Mr. Heintl are, nevertheless, very meritorious, and increase his reputation as a friend and patron of agriculture. We will now transcribe the reports of the Frontier Regiments, inserted in that gentleman's works, and to which we have referred in the preceding pages:

"WALLACHO-ILLYRIAN FRONTIER REGIMENT,

"*Caransebes, August* 10, 1811.

"In conformity to the general order, under date of June 27, 1810, the experiment of keeping silkworms in the open air, and maintaining them upon mulberry trees, have been instituted by the several companies under the direction of the Inspector Hoesich.

"It appears from the reports of the companies and of the Inspector, that the eggs were exposed to the sun as soon as the worms could feed upon the trees, and that a considerable number were hatched, which were colonized upon a well-grown and sound mulberry tree, in each company: they fed well, and I hoped to be able to rear them, but at the first shower they were washed away from the foliage and perished. In a few moments no trace was found of them upon some of the trees, and, according to information received from some of the com-

* This culture is at present offered for rent, under a guarantee of 20,000 florins, according to a notice inserted in the Gazette of Vienna, of the 28th of February, 1826, in which the annual production of silk is rated at 27,000 pounds weight.

panies, these insects died chiefly during the night, and ants and wasps made great havoc among them. On the trees of one of the companies, were found seventeen worms that had already spun their silk, but which were also killed by the rain and strong winds, before they had become butterflies.

"I shall conclude by observing, that the rearing of silkworms in the open air, can succeed in those countries and climates alone, where the temperature is subject only to periodical changes.

"I have the honor, &c. &c.

"COLONEL MICHALEVICS."

The report of the Frontier Regiment No. 12, contains nearly the same information as the preceding. "This little family of insects," it is said, "was, shortly after their coming forth, destroyed by heavy rains and strong winds. These worms had, however, sunk into the first torpor at Glogau, Perlasvorach, and Isbitic; and at Grebenaz they stood out the second torpor, when they were thrown from the foliage, and entirely annihilated by a storm of hail and heavy showers. The same fate attended those of Homoliz, Oppowa, &c. &c. though they had already begun to spin their silk; being, at that period of their existence, lazy and torpid, they were easily thrown from the trees. They suffered, besides, much from their numerous enemies, such as sparrows and other birds, which cause much destruction among them, should they even become inured to our climate, and procreate in the open air. At Starescoa and Pancsova alone, the worms had hung their silk balls upon the trees. Fifteen male and six female moths were found, the latter having deposited their eggs upon the cocoons, and they came to life again after a few weeks; but the moths that had come forth very soon perished.

"But on one thick hedge only, some worms had perfectly grown, made their silk, and deposited their seed in several places, and it is yet visible in about ten of these spots; but in the others, where the seed was exposed to the sun, it came to life, or was evidently eaten up by ants, or destroyed in some other way. The worms had deposited the seed in the same manner as they used to do upon paper, when they were reared in rooms; that is, in irregular forms, close to each other, and not upon the leaves, but upon the bark of the trunk and of the branches. The cocoons were somewhat smaller, and less rich in silk, than those proceeding from the worms that had been tended in rooms. It appears, lastly, from all the instituted experiments, that the climate does *not absolutely* prevent the thriving of silkworms in the open air: for ordinary rains, though frequent, did not injure their health more than cool nights; they remained healthy and fed well; and this fact refutes the assertion that the silkworms cannot bear damp and cold weather. It is, nevertheless, true, that the larger and heavier they grow, the more clumsy they are, and that they lose thereby the faculty, common to all moths, to remain unshaken upon trees; and high winds, especially when accompanied with heavy rains, easily throw them down. But it remains to be known, whether the worms proceeding

from the seed left in the open air, may not possess the same facility of clinging to the trees; and we must wait for the results of the ensuing year, unless the weather and ants destroy the seed remaining in the ten above-mentioned places, before spring.

"I have the honor, &c.

"COLONEL HORDINSKY.

"*Pancsova, Nov.* 23, 1811."

The Regiment of Gradiska kept an exact journal, which concludes with the following remarks:

"The silkworms which had lived for some time upon the trees, and died at last, did not feed well; and, compared with those of the same age, that had been reared in rooms, attained, in the same time, not a third of their growth in length and bulk, but were somewhat thicker towards the head, and, examined in the sun, they were rather rough. The experiment further proved, that the worms were not only destroyed by the sudden change of the weather, but partly by insects, such as wasps, flies, and ants. This happened the most frequently in hot weather, in the evening, when the sultry heat had somewhat abated, and the insects were seeking, upon the foliage and under the nets which had been thrown upon the trees, together with the silkworms, a shelter from the heat and the rain.

"COLONEL MINITINOVICH.

"*Neugradiska, October* 18, 1811."

The journal of the Frontier Regiment of Broda, No. 7, concluded with the following lines:

"On the 12th of July, the eggs of the remaining silkworms were still upon the trees. Some were hatched by the heat we had to-day, and the remainder were, as it were, burnt and destroyed; and, as the small worms were unable to eat the leaves, which were nearly full grown, they all died. As there remains no seed upon the trees for the next winter, the nets have been taken off and laid by till the spring. The worms that had been reared upon the trees in the open air had, however, been previously in very good health, but from the shortness of their claws, they could not well fasten themselves upon the trees, and most of them perished in falling.

"COLONEL MILLETICH.

"*Winkovez, Oct.* 25, 1811.

The reports of the other regiments are nearly of the same purport. The final effect of the experiment was a determination not to try it any longer: and the prize question, mentioned in § 33, was the first means of reviving again the scheme of cultivating silk in the open air.

§ 37.

We shall here quote the evidence furnished by several private individuals, in regard to the singular fate of the exertions of Frederic

the Great, in favor of the culture of silk. An inhabitant of Kuritz states, that the scheme was taken up very earnestly by government; reports travelled from one end of the kingdom to the other, like a train of gunpowder. All the towns' authorities, as well as the village communities, were compelled to plant mulberry trees, and to receive eggs the next year. The newspapers were full of high-sounding articles, &c &c. But what was the real state of things? The result was as significant as the conception was sound. Regulations were published, in regard to the culture, but every body soon said: "I cannot succeed—the worms die—they have the jaundice." The first distribution of the silkworms' eggs failed thus, almost entirely: but hope still remained in some bosoms. Several burgesses and peasants asked for a fresh supply of silkworms' eggs, and resumed the culture in the following year.

There came, from all parts, complaints of a want of mulberry leaves; the moths having been hatched too soon. Others lamented that the trees had suffered much from the severity of the winter, and asserted that they would never more thrive. Some kept the worms two, three, or four weeks longer, but lost them also, finally, either by scarcity of food, or the jaundice. Insensibly, the culture of silk fell into discredit, and is now in its former neglected state.

§ 38.

Let us see what the well informed Mr. Knuth says about the culture of silk in Prussia, in his above-mentioned work: "Our silk products," says he, (p. 96,) "at first undertaken, during the reign of the Great Elector, [Frederic William*] by French Huguenot refugees, did not amount to more than 13,000 pounds; and even to that quantity only, in one of the most productive seasons. However small this result may seem, and how disproportionate it is to the great expense of money and labor on the part of the government and the nation, the intention of Frederick II. to procure to the provinces, where the climate permitted it, a new source of industry and wealth, must be remembered with gratitude; and it is to be wished that the culture of silk could be preserved in public schools, in honor of that great monarch, and as an additional means of enlightening the mind of the growing generation, by the observation of an almost invisible insect, which comes forth under the care of man, grows, and at last yields a precious and useful substance. The mulberry trees of Italy have not a more beautiful appearance than those that grow about Potsdam and Frankfort. In Italy, also, the crops of silk are not unfrequently destroyed by the weather: now, by late frosts, and at other times, as for instance in the present year, by an excessive heat. But in the Milanese and in Piedmont, 5,000 inhabitants must get their living upon each square mile; whilst, in the circle of Potsdam, (exclusive of Berlin and Frankfort) fifteen hundred only are reckoned for the same extent of territory; and these

* Born in 1620—died in 1688.

obtain their subsistence by other pursuits, which would be of a more certain product, were it but for their association with old habits. From this may be deduced the principal reason of the little progress we have, as yet, made in the culture of silk. Our silk was not inferior to that of Lombardy, when prepared in the same manner; and was even considered superior, in fineness and strength, to the products of warmer climates."

§ 39.

This conclusion is somewhat corroborated by further information respecting the previous culture in Prussia. The ill success is in no way ascribed to the climate, but solely to the various blunders that were committed on its introduction: among which, we will only mention the compulsory measures which were employed, at times, and the little care with which the mulberry trees were planted and attended to, and the silkworms eggs, and the worms themselves, were treated. The jaundice or the plague would, otherwise, never have made ravages among these insects, no more than among men, if they never wanted food, and never neglected their health.

§ 40.

But the causes of the decay of the culture of silk in Germany, cannot be more distinctly stated, than in the following report of Count Reigersberg, Envoy of the King of Bavaria at Carlsruhe; a country where that culture was the most extended, at the time that Charles Theodore governed the Palatinate:

Report of the Bavarian Envoy near the Grand Duke of Baden, to the General Committee of the Agricultural Society, and to the Board for the Culture of Silk, in particular:

"The subjoined copy of a memoir, which Bailiff Hout, of Manheim, has transmitted to the Agricultural Society of the Grand Dutchy of Baden, contains, among other information, the intelligence requested by the General Committee, in their letter of February 18th.

"In transmitting this communication, to which I must at present limit my own concurrence, I think it my duty to add, that Mr. Hout is willing to furnish further information, and to supply you with white mulberry trees. I have, moreover, the honor of observing, that, according to my own knowledge, and the information I have been able to collect, Mr. Hout, who resides at Manheim, and the Inspector of Plantations, Mr. Kall, of Swezingen, are the only persons practically engaged in the culture of silk. Both these gentlemen, together with the Aulic Counsellor, Mr. Ziegler, of Manheim, who had previously paid to it some attention, are earnestly laboring to obtain the countenance of government for that branch of industry, persuaded, as they seem to be, that they would save thereby, to their country, a large sum of money.

"I had asked permission to consult the papers of the Secretary of the Interior, concerning this matter, in the hope of deriving from them important information; but, as they had not been filed, and as I but recently obtained access to them, it was not in my power to acknowledge sooner the receipt of your letter.

"I have the honor, &c.

"COUNT DE REIGERSBERG."

[*Memoir enclosed in the preceding letter.*]

"*Question.* Are any persons still engaged in the production of silk?

"*Answer.* At present, silk is only cultivated at Manheim, in the workhouse, and at Kircheim, near Heidelberg, by a man called Jost Gieser, who has made 40 florins 40 kr. within the present year, by 51 pounds of cocoons.

"*Question.* Was the rearing of silkworms, previously, a favorite pursuit? Why was it relinquished?

"*Answer.* Silk was, formerly, never cultivated at Manheim, although considerable white mulberry plantations had long since existed in that district. I cannot state the reason. The culture of silk having been introduced in the Palatinate at public expense, and having become, in later times, the monopoly of a company, who has constantly been assisted by the government, the following remarks concern the whole country, but especially the late bailiwick of Heidelberg, where the culture of silk was the most extended.

"This culture had already been introduced, in 1753, by J. P. Rigal, with privileges granted to him by the government, to be enjoyed until the year 1777. Several communities, and some private citizens, encouraged by these favors, showed themselves ready to contribute to the attainment of the desired object; and, for instance, the villagers of Kircheim near Heidelberg, prided themselves, with the Elector, upon their zeal for the culture of silk; proving that they had paid in the year 1777, their taxes, almost wholly, with the profits they had derived from that industry, and that day laborers had earned by it, from 60 to 70 florins a year. Nevertheless, a general dislike broke out against it in the community at large, who could neither brook the great favors, privileges, and bounties, granted to some, nor the compulsory measures employed against the citizens in general.

"According to the voluminous documents from which we derive our knowledge, that dislike did in no way proceed from a belief that the climate was uncongenial to the culture, or that the labor, which it requires, was too heavy—those who were engaged in it, becoming rather more attached to it by degrees; but it had its real origin in the privileges by which the above-mentioned company enjoyed a real monopoly, and enforced the purchase of their products at certain prices, through the confiscation of all other products, and the forced sale of all the cocoons, at the rate of 30 kr. per pound, under the penalty of fines and bodily punishments. The aversion of which we speak, was further increased by some extraordinary examples of severity, as was the case

in the bailiwick of Alzei, where an offence of that nature was punished by a fine 440 florins 42 kr., and by the appointment of twenty-nine head men, who received, at the expense of the bailiwick, 30 florins a year, independent of a relief from some personal and soccage services, of a daily pay of 45 kr., and an additional remuneration of five florins for each hundred of trees that were planted within the boundaries of the community; and over whom were placed special inspectors, who enjoyed the same exemption from personal and bond services, and some other taxes, and received two florins for each hundred of trees, besides a daily pay of 30 kr.

"As it was required to carry the trees from and to Heidelberg, the trouble this occasioned was another cause of discontent; and the little treasuries of the townships were often roughly dealt with, under the pretence of the advances necessary for the purchase of mulberry trees. Each inhabitant, whether a public officer or a private citizen, or an owner of an acre of land, was compelled, without any consideration of his circumstances, or any regard to the species of culture to which he had adapted his land, to have six trees upon each acre, within a given space of time. Each new settler was obliged to plant two trees; each villager one; each individual paying certain taxes one; all the holders of patrimonial estates to uses, or in trust, a fixed number; and trees were to be planted upon commons, streets, causeways, boundaries, trenches, and church-yards: whereby fifty thousand trees were transplanted, by the inhabitants, from the nursery of the company, within one year. The grubbing and fixing in the ground of the mulberry trees, was the particular task of the twelve youngest members of each community. Any damage done to the trees was punished, in the first instance, by a fine of ten dollars, and, in the second, by detention in a house of correction. To all this must be added, forest taxes, which presented the remarkable fact that the *per diem* of the foresters considerably exceeded the ordinary price of the young trees that were pretended to be given *gratis*. These burdens were, it is true, taken into consideration by the government, in the year 1792, and it was acknowledged that the culture itself was not the occasion of public discontent; but that the griping spirit which characterized the compulsory measure of distributing the mulberry trees; the low prices at which the cultivator was obliged to sell the cocoons; and the long list of unreasonable mulcts, charges, and costs, had irritated the people, and rendered odious to them, an industry which, otherwise, would have been so well calculated to please them. Whilst, from 1792 till 1804, many reports reached the public authorities, and many inquiries were made, and a vast quantity of papers was accumulated, the irritated citizens viewed the long delays which the new promised organization experienced, as a revocation of the previous regulations, and endeavored to free themselves, by their own exertions, aided by a concurrence of favorable circumstances, from an industry which, as it appears from the facts stated in the authentic documents, had become a real calamity to the country, by being the offspring of the spirit of monopoly and of tyranny.

"At Heidelberg, Ladenburg, and in that whole neighborhood, the mulberry trees were felled; and in Ladenburg alone, a plantation of upwards of 5,000 full grown trees was suddenly destroyed.

"The Elector Maximilian Joseph, who succeeded Charles Theodore, abrogated the compulsory system; and with it disappeared all the offences, complaints, and litigations, which it had occasioned.

"*Question.* How much silk was produced within each year?

"*Answer.* Notwithstanding the above-mentioned mistakes, the list of which could be increased by the enumeration of many analogous errors, there were, nevertheless, in the country, 110,777 full grown mulberry trees, in the year 1780; and the crop of cocoons amounted to the following quantities:

In the year	1777	15,024 pounds.
	1784	45,728
	1786	29,249
	1787	17,047
	1789	37,137

"*Question.* How many families lived upon this industry?

"*Answer.* It is impossible to state their number with precision, as the statement, if it ever were made, is lost. It appears, however, from a table made in 1789, that there were few persons engaged in this compulsory pursuit; and that tenfold more would have been produced, had it been left perfectly free. The 37,137 pounds of cocoons, for which the company paid at the rate of 20 rr. 30 kr. would produce, in the present year, at the rate of 48 kr., 29,726 florins 36 kr.

"*Question.* Whither was the silk exported, and at what price was it sold?

"*Answer.* It generally was sent, by the company, to England, where it stood the competition of that of Turin, on account of its strength and general excellence; and, as it could be carried with much less expense to London than the Italian, the German silk brought a larger profit; but the price cannot be exactly stated: for it varied from one year to another, like that of all other superior products of the earth, according to the abundance of the crops and the general circumstances of commerce. At present the price of a pound of organzine is 16⅜ florins, and of the quintal, 1,687½ florins.

"Tram silk is sold for somewhat less.

"*Question.* What is the amount of capital which this culture brought into circulation?

"*Answer.* This question has already been answered, and I need only add, that a large quantity of cocoons was smuggled into Strasburgh, where they commanded a better price than the company chose to pay. The preceding statement includes only those which were delivered at Heidelburg.

"*Question.* How many mulberry trees were required by the culture which was carried on in that neighborhood? Of what species were they, and how many remain at present?

"*Answer.* The first part of the question cannot be answered, for the trees were of different ages. Of the immense number that were planted, the peasants left but few to grow up, and perhaps not half of those that existed were made use of.

"According to the statement given above, there were, in the year 1780, 110,777 full grown mulberry trees in the Palatinate. A white mulberry tree, 20 years old, planted in a proper soil, produces, on an average, two quintals of foliage, and about seven quintals are required for 40 pounds of cocoons.

"The mulberry tree, (morus alba,) planted in the Palatinate, had grown from the seed. The trees were not improved by the species which bore large leaves; and only those, the leaves of which were too small, as is often the case with cuttings, were thrown away or used for hedges. Few old trees remain at present in the Palatinate. During our long wars, when the peasants had much ado to provide themselves with necessaries, and to lodge and maintain the enemy, the mulberry trees, which the spirit of devastation respected, fell into natural decay. In most of the villages, the mulberry tree is almost unknown to the present generation. There are yet in the neighborhood of Kircheim a few old trunks and hedges, or rather the offspring of the old trunks which had been cut down. A good many are yet to be found in the gardens near the palace, at Manheim, and along the causeways that surround the city; and several thousands have been planted, through the care of the institution for the revival of the silk culture, created six years since.

"The last question naturally leads to some further remarks upon what has been done at Manheim, during the said space of time.

"But first we must say a few words upon the possibility of cultivating, with profit, silk in our country, and on the protection which that industry requires on the part of Government. According to long experience, the mulberry tree thrives among us as well as the common fruit trees, and has, besides, the advantage that it bears, without material injury, inundations and spring water. The experience of many years, and the experiments tried in the last six, prove sufficiently that the culture agrees at least as well with our climate as with that of those provinces of France and Italy, which, for several centuries, have been considered as the principal seats of the silk culture in Europe. Whilst it failed so completely in those countries during the years 1816 and 1817, that the price of the silk was more than double—the pound selling at 28 florins: we nevertheless obtained good crops, though we had no other food for our worms than the foliage of the hedges. Several French agriculturists, well acquainted with this culture, maintain that the environs of Paris are more convenient for it than the southern provinces of France;* and it is possible that the climate of

* Whilst we were revising the present sheet, we found in the Moniteur of the 10th of April, 1826, the following article, which confirms the remarks stated in the text, and those which will be found in § 33: "The second scheme, relative to the cultivation of mulberry trees, and the rearing of silkworms, has been for his Majesty a new opportunity for providing, with his usual munificence, a public establishment. A model

our country much resembles that of the great French capital. Hail and oppressive heat, those two great adversaries of the cultivation of the silk, are, in our country, more rare than in Italy and France; and frosts in the spring, which sometimes destroy the foliage of the mulberry trees, are less frequent than the dangerous meteorological phenomena previously mentioned.

"There remains not the least doubt, that we can produce silk as cheap as the French. The cultivator in the southern provinces of France, lives, according to recent information, much better than ours. In the Sevennes, female spinners receive 42 kr. a day, and twiners 21 kr.; whilst, among us, women, well acquainted with that kind of labor, will work for a third of the money. The mulberry tree can, therefore, be planted, and the culture of silk pursued with advantage, in the plains of the Grand Dutchy, and even in the southern valleys. The silk is at least equal in quality to that of Turin. This is sufficiently proved by the evidences brought together in the authentic documents of an early period. Not long ago, in weaving silk imported from Italy and from Manheim, we found that the weaver, who had been accustomed to Italian and French silk, preferred, by far, the organzine of Manheim, for its greater strength and equality.

"It is known that, in the south of Europe, millions of individuals live entirely, or partly, by the rearing of silkworms, and the improvement of their precious webs. The female portion of the population, and children, are chiefly engaged in this industry; which thus furnishes means of subsistence to that portion of the population of a country, which every where, and principally in large cities, have so much difficulty to provide for themselves, and weigh constantly upon charitable institutions. To this must be added, that the culture of silk gives employment to a great number of hands, the place of which cannot be supplied by machines, and that the labor is pursued in the season when little is done in the fields, namely—immediately before the hay harvest.

"The present low price of all other agricultural products, renders the acquisition of a new industry most desirable, and especially of one which, with the constantly increasing luxury, promises to be an exhaustless source of pecuniary profits. If things could only be brought so far as that the Grand Dutchy were enabled to produce tenfold the quantity of cocoons which a few bailiwicks of the Palatinate furnished to the company in 1784, the value of this branch of industry would be increased by 30,000 fl. at the rate of the actual price of silk; and averaging the price paid for the reeling and entwining at one florin only per lb., there would be a gain of 25,000 fl. for children of both sexes. This valuation is no way exaggerated: for authentic documents

farm will be opened in the sheep cot, near Corbeil, which has been bought, by order of the king, with a view of trying again the experiments recently made in the Departments of Jura and Allier; and which have triumphantly refuted the old assertion, that such experiments can only succeed in the Southern provinces. The increased means of cultivating the mulberry trees and of rearing silkworms, will tend to free France from the tribute which it still pays to foreigners for a third part of the silk which is fabricated in our manufactures."

prove that the late Palatinate, which constitutes but the third part of the Grand Dutchy, could alone easily have verified our hypothesis.

"The silkworms feed exclusively upon the leaves of the mulberry tree, of which there are several species. The white mulberry tree is preferable: it belongs to the class that grows the quickest, but needs, nevertheless, from the seed corn, up to the time that it becomes a dwarf tree, or coppice, from eight to ten years, and eighteen, to become a useful standard. The *Morus rubra* of America, is perhaps the most profitable; but we possess not particulars enough about it, to recommend the plantation of this species unconditionally.

"Such a want of information may also explain why private individuals have not as yet spontaneously introduced this culture into their country. For more than a century, several sovereigns, from Henry IV. down to Louis XV. applied themselves earnestly to procure this branch of industry to the French nation; and millions were spent for that object, which now produce, and long will continue to yield, a large interest. Even at present the government continues to assist it; and it is not longer than two years since, that the Prefect of the Rhone Department promised a reward of three thousand francs to the community which should rear the greatest number of mulberry trees.

"The facts above-mentioned, induced, some years back, Mr. Ziegler, then bailiff, and at present Aulic Consellor, and the late Municipal Counsellor, Mr. Schumacher, to plant white mulberry trees in this district: and, in later times, the Ducal Administration of the Circle was authorized to apply, yearly, a few hundred florins, from the city funds, to a nursery, and an extensive plantation of these trees. Although the directors, Manger, Hinkeldey, Stengel, and Siegel, were convinced of the utility of the scheme, and endeavored to promote it by all means, they were, nevertheless, unable to devise a more active method of supporting it. In spite of such feeble encouragement, the following results were, nevertheless, obtained under the auspices of the writer of the present paper:

"1st. A nursery of half an acre in extent, in which white mulberry trees are brought up, partly from Italian, and partly from French seed.

"2d. A plantation of coppices of 3,000 trunks, which are encircled by a hedge-row, containing about 4,000 bushes.

"3d. A plantation of about 800 standard trees along the dykes of the Neckar.

"4th. A plantation of 900 standards, 900 in a brush wood, and a hedge-row, which encloses 1200 bushes.

"Her Royal Highness, the Grand Dutchess Dowager, having, during the scarcity of the most indispensable necessaries of life, in the years 1816 and 1817, organized, and largely contributed to a charitable society for the support of the indigent classes, an attempt was made, upon the suggestion of the Privy Counsellor and City Director, Mr. Jageman, to rear silkworms, on purpose to teach this useful art to the children of the poor. The enterprise succeeded astonishingly. In the first year, 157 pounds of cocoons were obtained; from which 13 pounds of organzine were drawn, mostly by those little untutored

artisans. The organzine was employed in the fabrication of a piece of velvet, which was presented to the Grand Dutchess, by the Charitable Society.

Through the assistance of that society, and a present from the Princess, three excellent carding machines were procured from Piedmont, a mill for linen thread, of eighty bobbins, and a loom for the most delicate species of silk-woof. Her Royal Highness having afterwards become more convinced of the utility of this new enterprise, had recourse to the government for considerable pecuniary assistance, which was to be applied to the purchase of a house, with a piece of ground of about 15 acres, for a nursery and school of plantation.

"But a change of circumstances prevented these plans and prospects from being further realized; and all assistance is at present limited to a yearly allowance of 400 florins from the funds of the bailiwick, and of 100 florins from the public treasury; which are so much the more insufficient to promote the intended purpose, as the plantations have already attained a considerable extent, and as even these inconsiderable pecuniary allowances have not been paid for two years.

"Should, therefore, the Agricultural Society share my views, respecting the utility of introducing the culture of silk, it might be desirable that the Society should think proper to prevail upon government to lend its powerful aid, to the end of reviving that profitable industry in this country, where it already once flourished, and of letting it act, henceforth, freely and undisturbed. During six years, we tried all sorts of experiments, and have gone through the whole process of cultivation and fabrication, from the planting of the seed corn of the mulberry tree to the production of a piece of velvet, which the Grand Dutchess found beautiful enough to wear herself; and thus we have been convinced that it would be unprofitable to follow the old method prevailing among the Italians and the French, as more than a human age would pass before we could produce silk, should we pretend, like those nations, to employ, exclusively, full grown trees for the rearing of the worms.

"We have tried, with good success, the method proposed by some modern agriculturists; but we want the light of further experience, to determine upon their adoption in this country, and to pronounce, definitively upon their usefulness. Should the above stated facts merit the attention of the Agricultural Society, the writer will consider it a duty, as soon as he shall have finished some new experiments, to submit to the Society an exposition of a new method of cultivating silk, founded upon the experience of several years, and the combined knowledge of our climate, and of our agricultural system in general: both of which differ much from those of the Milanese and the French.

"We accompany the present paper with a sample of ordinary yellow silk, of White Chinese Silk, which is still rare even in Italy and France, and half a yard of black velvet—all products of our own industry, though but a first attempt; and we hope to demonstrate, thereby, the excellence and beauty of our native silk, and the possibility of using it for all sorts of stuffs. "HOUT.

"*Manheim, September* 1, 1821."

"It is now four years since the writer composed the preceding pages, and after having, in the mean while, collected much additional information in regard to the culture of silk, he is persuaded of the correctness of his statements respecting the possibility of introducing it, with considerable advantage, in every country in which the finest species of fruit trees thrive; having found that, generally, silk prospers better than *hops* and the *vine;* and if, as was observed to him by the Agricultural Society, it has not been heretofore attended with success, in some parts of the Grand Dutchy of Baden, and in the neighborhood of Strasburg, it must be ascribed either to local circumstances, or to the want of skill on the part of the cultivators.

"He intends, upon some future occasion, to develop some further views respecting this subject, which are suggested to him by an expeperience of four years; and he begs leave to express the wish that this culture, at once so useful and so well calculated for the Grand Dutchy of Baden, and all the provinces of Bavaria situated along the Rhine, the Maine, and the Danube, might obtain the countenance of the respective governments.

"HOUT.

"*Manheim, April* 6, 1825."

§ 41.

In regard to the culture of silk in Bavaria, and its abandonment, we have the following details furnished by a public agent, who was lately employed in that business.

"By a letter, dated April 1, 1822, the Superintendent of the Royal Gardens has informed the General Committee of Agriculture that the dyer Seyfried, having been one of the public agents employed in the previous endeavors for the cultivation of silk, is perfectly able to furnish them the most correct intelligence upon this subject." "Thereupon, (says the above-mentioned Mr. Nagel, in his report,) I went, on the 3d of April, at the invitation of the Counsellor of State, Mr. de Hazzi, in behalf of the General Committee of Agriculture, to Mr. Seyfried's, and conversed with him about an hour, respecting the culture of silk, as it exists at present, and in regard to its previous state. The following are the principal and most important facts thus collected.

"1st. Mr. Seyfried had been attached to the Silk Institution which existed under the late government, as planter of mulberry trees, rearer of silkworms, and inspector of the carding and spinning of the silk, with a salary of 350 florins *per annum*, and held his employment for nine years. His Excellency Count Torring-Gronsfeld was President of that Institution.

"2d. Mr. Seyfried planted mulberry trees around the city, which were numbered, grew rapidly to a prodigious height, and were uncommonly beautiful and rich in foliage. It was soon necessary to join two ladders, in order to reach the foliage of the upper branches, which, generally, is the best. According to Mr. Seyfried, there exists still one of these trees, in the garden belonging to Mr. Utzchneider's cloth

manufactory, and another in the kitchen garden of the Augustin Friars, who made some trifling experiments in the culture of silk.

"3d. The worms, having been all well hatched and reared, produced cocoons so beautiful and so abundant in silk, that Seyfried gathered, in the first year, 110 pounds of that substance, and the seed for the future breed was so excellent, that there was no need of any foreign supply.

"4. According to Mr. Seyfried, there is less danger of a year's culture being destroyed in Bavaria than in Italy—the higher temperature of the latter country being often fatal to the worms. We keep the worms in the usual temperature, which can easily be regulated in the rooms by a thermometer.

"5. The Government allotted yearly 6,000 florins to the Silk Institution; which sum was taken from the product of the custom-house duties upon foreign silks. The State gained by it 50,000 florins, which it lost, of course, when the Institution ceased to exist.

"6. The decay and dissolution of this establishment must be ascribed to the merchants, who persuaded the Government that they would be ruined, should it longer continue in existence; and that the State, too, would soon discover and feel the disadvantages which it produces. They had calculated, with a true mercantile spirit, that, where silk is produced, manufactures would soon abound, and domestic fabrics would soon increase in value and in price; whereby the price of the foreign commodity must fall, and the products could not be forced upon the purchaser, or sold with large profits. They were listened to, and the Institution was suddenly discontinued, under the pretence that the culture of silk could not be long continued in Bavaria, and that it was rather injurious than profitable to the State. It was ridiculously added, that the worms were often hatched before the leaves had shot out, in consequence of which whole broods perished. Pensions were granted to those who had been agents of the Institution; the trees were cut down; the kettles, spinning machines, and the whole laboratory, were broken up, sold, put in store, or thrown away, on purpose that such an institution might not soon be revived. Mr. Seyfried deplored much the decay of an establishment which had produced to the country great and manifold advantages; and he thinks that manufactures will never flourish in Bavaria, as long as our neighbors shall exclude us from their markets, and we, on the contrary, shall receive their products."

A person acquainted with the subject has furnished us the following details, in regard to the progress of the culture of silk at Landshut:

"During the glorious reign of Charles Theodore, the Electoral Regency of Landshut was dissolved in 1779, and re-established in 1784, when Baron Dachsberg was appointed Vice Regent, and, upon the Prince's command, entered into an agreement with some private individuals for the culture of silk.

"The then existing Electoral hop-garden, which occupied a space of eighteen acres, and which, according to the intentions of the Elec-

tor Maximilian III, was to be the first hop-nursery of the country, was given up to the new culture; and the present Military Hospital was considerably enlarged, with a view to serve for the rearing of silk-worms. Several sunny spots were selected in the garden, and sown with mulberry trees, which soon grew up so luxuriantly, that, in the second and third year, full and thick hedge-rows could be formed, and several thousand young trees were planted. By these means, a sufficient quantity of leaves was obtained to rear several thousand worms from the eggs which had been procured from Italy. In the meanwhile, with the view of pursuing the culture on a great scale, the plantation was increased one-half of its former extent; bulldings were erected at one extremity of the garden, for the spinning and weaving of the silk; and several hundred plants were formed into hedges,* and young trees were distributed gratis to persons inclined to pursue that species of industry, to convents, and to agriculturists. The culture was thus enlarged from year to year. By the rapid growth of the trees, there was no longer a want of food for the worms, and leaves were produced in such quantities, that the worms augmented by thousands every year, and the spinning of silk accordingly made rapid progress.

"A dying establishment took charge of all commissions; whereby two weavers could be employed, who furnished all sorts of articles of satin and velvet, and knitted as well as woven stockings. Private individuals had already furnished several pounds of cocoons: and such contributions would have become more numerous, had one of the most essential conditions of the progress of the culture been attended to: I mean a sound instruction with regard to the means of pursuing it. In spite of the cold weather we had occasionally during the spring, and the great cold we experienced during the famous winter of 1788, which injured considerably the culture, it would still have continued in general favor, had not the war begun soon after, and thrown every thing into confusion. From the year 1789, when Austria sent an army into the Netherlands, the country was constantly overrun by soldiers; and Landshut being situated on one of the principal military roads, the zeal for the culture of silk diminished in that city; and Baron de Dachsberg having died in 1798, the culture and the garden shared the same fate—an utter neglect. The trees were cut down one after another, and but three of them remain in that whole neighborhood. Thus failed so promising an enterprise, which might have been pursued to the greatest and most profitable extent.

"LICENTIATE BACKHAUS, *Dyer.*

"*Landshut, January 27th,* 1826."

* See the ordinance for the introduction of the culture of silk, published on the 26th of January, 1783, (Art. 6.) From some reason unknown to me, the young plants that were employed for hedges were distinguished by the name of *charmilles;* perhaps because they were reared in espaliers, as is the case with the hawthorn, which is sometimes called *charmilles* by the French.

§ 42.

It appears, moreover, from the papers belonging to the late Silk Directory, that the decay of this culture must not be wholly ascribed to a hostility on the part of the merchants, as it is asserted by Seyfried; but that the institution harbored in itself the seeds of its destruction: for,

1st. It was a great mistake to have connected, from the beginning, with the production of silk, an extensive fabrication, and to have erected large buildings, stores, filatures, and appointed several officers with salaries; by all which much money was expended before there existed a single worm, or any means of nourishing it.

2d. No less mistakes were committed in the plantation of the trees; which partly were planted in marshes, upon roads and public walks, and, partly, were wholly neglected in their first growth. This produced diseased trees, or a dirty and dusty foliage, and, as an inevitable consequence, the enfeebling and death of the worms.

3d. On the other hand, public agents, employed in the rearing and feeding of the worms, attended to this business less than persons who would have pursued it as a matter of amusement, or with views of pecuniary interest. Often the worms were not fed at the right time, and little looked to, and the diseased were not immediately separated from the healthy: an epidemic thus spread amongst them, which was called jaundice, from the color which they assumed, and because their whole organization resolved itself into a yellow slime. The disease spreading rapidly, thousands of them perished. It is a well known anecdote in Munich, that, when the Elector, Charles Theodore, insinuated that he would visit the silk establishment, at a time that not one worm remained, the agents ran through the whole city to procure some, by dint of money and fair words; and that a hairdresser furnished them, at last, twenty thousand, which were immediately carried to the establishment, and exhibited to the Elector, who expressed his great satisfaction, and rewarded the agents for their zeal.

4th. The worms were, moreover, lodged like soldiers in the barracks; a prodigious quantity of them being kept together in one or two rooms. An unwholesome evaporation, the want of fresh air, and the impossibility of moving freely, produced among the worms diseases and epidemics, exactly as it happens in hospitals overfilled.

5th. Most frequently the worms were hatched before the foliage had begun to grow; and millions of worms thus died, as soon as they had come forth.

6th. There was also often a need of leaves in the third or fourth age of the worms, from an impossibility of husbanding the food, and from an erroneous estimate of the quantity which the worms required: for they need such a large quantity from the third to the fourth age, that a deficiency was unavoidable, since there were few trees, and no proportion had been observed between their number and that of the worms; and a scarcity of food could not fail to occasion diseases among them.

7th. When mulberry trees and silkworms' eggs were distributed among the inhabitants of the cities and of villages, they lacked still—as is proved by the account of what happened at Landshut—a competent knowledge of the proper manner of planting and rearing the trees, and of the treatment which the worms required. Failures produced discouragement, and nobody was willing to think more of the culture of silk. The discontent became greater, from the circumstance that, in most cases, there was no prospect of receiving cash for the silk. The sale of the cocoons was not well regulated: it was connected with difficulties, which amounted, sometimes, to a positive refusal: Large quantities of cocoons, the product of the year 1780, have been sent to the Board of the Culture of Silk in the present year, (1826) in consequence of the offer they had published to pay one florin for the pound of good cocoons. It is true that these cocoons, which have been preserved so long, were partly spoiled by moths, and can only serve for floret silk, but cannot be employed for stuffs.

8th. This concurrence of circumstances, cannot give a favorable idea of the culture of silk, in the 17th and 18th centuries. Instead of an institution fit to promote a new branch of production and of industry, there were but the expensive and onerous measures of the Government, which occasioned a general outcry: and soon followed a long war, which finally destroyed, for a second time, the culture of silk.

SECTION III.

Of the true ways and means to introduce the culture of Silk, to maintain and to promote it.

§ 43.

I shall begin by repeating the opinion expressed in the discourse I addressed to the Board of the Culture of Silk, quoted in § 28, the correctness of which is demonstrated by the course of events in Bavaria, as well as in China, Greece, Italy, and France, and which flows from the nature of things, and is applicable to every industry. * "No "Board connected with the government, no particular administra- "tion, no public officers, no expenses. Let the culture of silk be an "affair wholly belonging to the people; an incidental business; the "secondary work of servants, children, paupers, and old people. "Encouraged by the example of Greece, Italy, and France, we wish "to trust it to the fair hands of ladies, who could, by way of amuse- "ment, and without any expense, obtain, within six weeks, a most "elegant material for the ornament of their persons, and of their "apartments."

* Page 22.

If the culture grows up in this manner spontaneously, no complaints can arise; it is, then, a voluntary and profitable occupation, unattended by any kind of expense.

§ 44.

No doubts can any longer remain in regard to the possibility of getting forward with this culture, as many facts clearly prove that it thrives in all countries; in those of the South, as well as in those of the North. It depends upon two things: upon mulberry trees and silkworms. The former must furnish the food for the worms; and, when this is provided, the worms need only to be fed, and kept clean, like birds in cages.

§ 45.

It is with the white mulberry tree, as with the fine fruit trees that have been imported from Asia into Europe, and which have grown luxuriantly, and furnish even better fruits than when in their native clime, as we see in France, in Germany, and even in England. The mulberry tree is long since accustomed to our climate, and is even improved. Experience shows that this tree is less sensible to the cold than other fruit trees; and that, though it keeps its foliage longer than any of them, it suffers less by late frosts. Even in regard to growth, the German mulberry is not inferior. The trees that remain in Prussia, from the former culture, though neglected, thrive luxuriantly; and many of them afford the refreshing shade of old lime trees and beeches.

The same happens in Bavaria, where there are still many beautiful remains of the former culture; but the trees are straggling, principally near Munich, Wurzburg, Köllnbach, Aichstädt, Schönach, Gottafing, &c. &c. The information we have collected, proves that the numerous mulberry trees that were planted forty years since, would still be in a prosperous state had they not been cut down.

§ 46.

Experience has also abundantly demonstrated, that the silkworms thrive as well in Germany as in Italy and France, and that the climate of Germany agrees better with them: for an excessive heat does them great injury; and it is easier in our country, and in all those of the North, to keep up an equal temperature during the cold weather, which is not unfrequent, even in Italy. The former, like the recent experiments instituted in Germany, and especially in Bavaria, show further, that the silkworm is less delicate than other species of moths, bearing, without injury, the vicissitudes of the atmosphere. Nothing, therefore, is to be apprehended from diseases and epidemic disorders, if care is taken to provide them daily with a sufficient quantity of clean and dry mulberry leaves, and an equal attention is paid to their

regular feeding and cleanliness. The cocoons that are thus obtained in Germany, are in no respect inferior to those of Italy and France; nay, the silk manufacturers are of opinion that the German silk is preferable, on account of its greater elasticity; and should the former mistakes in the plantation of the mulberry trees, the feeding and tending of worms, be avoided, nothing would prevent the success of this culture in Germany.

§ 47.

With a view of going methodically into all the details connected with the subject, of which it is our purpose to speak in the present section, we deem it convenient to divide the matter under the following heads:

I. Mulberry trees, and the care they require. II. The rearing of worms. III. The support which government could lend to this culture. IV. The manner in which a society instituted for the purpose of fostering this culture, could co-operate to its success.

§ 48.

1. *On Mulberry Trees, and the care they require.*

The most instructive essays on mulberry trees are Bonafous' little work, entitled "*De la Culture des Muriers*"—Paris, 1824; and the Instruction which, by the direction of the Board of the Culture of Silk in Bavaria, has been published by His Majesty's gardener, Mr. Seitz. We shall combine, in the following pages, the information which these two works afford, with the most recent observations and experiments.

§ 49.

a. On the Mulberry Tree in general.

At the beginning of the culture of silk in Europe, the black mulberry was principally used; but, upon more experience, it was found that the white mulberry [Morus alba, L.] is the only one really fit for this culture. The superiority of the latter consists in its being clothed with leaves 15 or 20 days earlier than the other species. The silkworms come, therefore, quicker to maturity, and are preserved from the inconvenience of the hot season. The white mulberry, moreover, not only grows more rapidly, but has a more abundant foliage, and the leaves are more delicate and more nutritive; whence the silk becomes handsomer, and of better quality. But there is a considerable difference in the quality of the white mulberry trees. Count Dandolo, the great silk rearer of Italy, considers those as the best which grow in Lombardy, under the name of *Folia Giazzola*, and *Folia Doppia*, the leaf of which contains five different substances: 1st, the fibrous substance; 2d, the coloring matter; 3d, water; 4th, the saccharine substance; 5th, and the resinous substance.

The saccharine matter is the most essential part in the nourishment of the silkworm. The more the leaves contain of it, in comparison of the other elements which compose it, the better is the tree adapted to the purposes of the silk culture; and this depends principally on its quality, its size, its age, the process which had been observed in rearing it, and in the dampness or dryness of the season.

Generally speaking, the broad-leaved trees are preferable to those that have small and indented leaves. As botanists place the white mulberry tree in the class of Dioecious plants, or such as have barren or male flowers on one individual, and fertile or female ones on another of the same species, it may be convenient to plant, exclusively, *male* mulberries, which afford the advantage that, not only on stripping them, the berries do not embarrass the operation, or cause a diminution of its product, but that the worms, in their last age, are not exposed to be fed on leaves affected by the glutinous substance of the berries, which would injure their health. Moreover, the male trees keep for their foliage all their juices; whence their leaves are in greater quantity, and of a better quality.

§ 50.

b. Soil and situation.

The nurseries, as well as the large and small mulberry plantations, require a sunny exposure, and spots well sheltered against strong and cold winds. Therefore, declivities descending towards the east or south-east, and screened by woods or groves, are proper; and also all spots protected by artificial plantations and buildings. The trees must never be planted in a marshy ground, nor upon great roads, or in places where they are constantly exposed to the dust: for it sticks to the leaves, and exposes the worms to an unwholesome food. The mulberry thrives upon a fertile and sandy soil; and, next to this, on a calcareous and sandy clay; but a heavy clay, and fenny or marshy earth, are improper, because the bark becomes covered with moss, and the trees are slow in their growth, and liable to diseases of the heart. The disease extends, of course, to the leaves, which become injurious to the worms. A small plantation should be formed on a spot where the trees are the most sheltered, in order that, in case of such late frosts as we had in 1825, the mulberries of that spot might serve as a substitute until the other trees have fresh leaves. It is a remarkable fact, that, in the same year, 1825, the trees planted along a canal did not suffer by the late frost, whilst all the others were more or less injured.

However, such a late frost as we experienced on the 15th and 16th of May, 1825, is a rare phenomenon. In regard to the hedge rows, they must be formed in such a way as to allow, on all sides, a free access to the air; as experience has proved that a sharp frost principally injures but one side of them. Straw mats, supported by four staves, are an excellent shelter for the trees, and would also serve for the hedges. The dangers arising from night frosts can, lastly, be com-

pletely prevented, if care be taken, on the next morning, to shield the trees until evening from the direct rays of the sun. It is also advisable, after a frosty night, to sprinkle, before sunrise, the trees with cold water. One of these precautions ought, at any rate, to be employed with the reserve trees, in order that the worms might never altogether be without a supply of food.

§ 51.

c. On the Seed of the White Mulberry Tree.

The certainty of obtaining sound and useful mulberries chiefly depends on the quality of the seed. The best is derived from trees that are perfectly healthy are not too old. The trees selected for that purpose should not be stripped of their foliage within the same year. If the berries fall towards the middle or the end of the summer, it is a sign that the seed has ripened, and it should accordingly be gathered. The berries must be thrown into a vessel full of water, and mashed with the hands, to clean the kernel perfectly; and the vessel should be emptied and filled several times with fresh water, till all the berries are mashed, and the seeds are clean. They should afterwards be laid upon a linen cloth, and dried in some airy place. It might be thought that the seed ought to be immediately sown in the seed-beds; but, to avoid the inconveniences of the raw season, and of the rapidity with which the winter sometimes sets in, it is better not to sow it before the ensuing spring. It is to be, in the mean time, mixed with dry sand, and kept in a fresh and dry place, perfectly sheltered from the wind. In countries where there are no tall mulberry trees, at the beginning of the culture, the seed must be procured from Italy or France. From 9,600 to 10,000 seeds weigh about one ounce of our (Bavarian) weight; and 320,000, or at least 300,000 plants, may be considered the average product of a pound of seed.

§ 52.

d. Of the raising of Mulberry Trees, and their management in the first four years.

Mulberry trees can be raised—1st, from the seed; 2d, from roots, 3d, from layers; 4th, from cuttings.

1st. *From Seed.* Although we have said that the spring is the season of sowing the seed, the precise time cannot be fixed for each country, for it depends upon the climate. But it may be laid down as a general rule, that the young seedlings must not be exposed to the late frosts, which might greatly hurt them. The best time for sowing the seed in Old Bavaria, is towards the end of April. The ground, intended to serve for the seed-beds, must have been broken up and dug, in order that, after having been penetrated by the cold, it might be the more loose and the more fertile. Should this method not have been

observed before the winter, it must be done some two or three weeks, at least, before the sowing. When that time comes on, the earth must be once more well stirred, cleaned, levelled, and divided into beds of four or five feet. Drills of six or eight inches asunder must be then made, with small hoes, and by line. Two days before the sowing, the seed must be steeped in water, and afterwards rubbed upon a packthread, which must be laid in the bottom of the drill, and covered with earth; the drills being made two inches deep in a light soil, and one inch only in a heavy one. When there is any reason not to use packthread, the seed, after having been moistened, should be left to dry in the air, and sown in the drills, which are to be covered with earth, as before directed. The first method is preferable to the latter, because the seeds are regularly sown in lines, and not so close to one another. Should the weather be dry during or shortly after the sowing, the beds should be watered immediately after the seed has been sown, and for some days afterwards, to promote its vegetation. The seed generally begins to sprout within twelve days, when sound; and no alarm need be felt if it should be later, as was the case in 1825, when three weeks elapsed before the plants appeared. The beds must be kept clear of weeds, which would retard the growth of the plants, and be defended against the frosts, which could destroy all the seedlings in one single night. To guard them against such dangers, it will be prudent to strew upon the beds, fir or other evergreen twigs, which may be left upon them until frosts are no longer to be feared. They serve, also, for the seed beds, as a good defence in raw weather, when the winds are from the north or the east, or when the sun is very hot. In countries, therefore, where similar atmospherical influences are apprehended, the beds are to be sheltered in the manner above-mentioned; but the twigs should not be laid too close upon the beds, for fear of suffocating the seed. They might, also, be covered with mattings, or with chopped straw, in order that the shoots may be sheltered as soon as they appear. It is less advisable to raise seedlings in hot-beds, because they are then more liable to injury from exposure to the open air. Their growth may be promoted by leaving to the shoots, at first, but one bud, which would be nourished by the whole sap, and the main stem then becomes straighter and stronger. This must, however, be done with great caution, and before the plant comes into leaf: for the proposed method might, otherwise, occasion more evil than good. If the young plants appear crisp, the lateral shoots should be lopped, to leave to the principal sprout its whole vigor. The plants must be watered during the summer, and cleared of weeds. If the surface of the beds harden, or grow dry, it ought to be stirred between the drills, to render it more permeable to heat and moisture. Towards the end of August, or the beginning of September, a rich and fat soil ought not to be watered; otherwise, on one hand, the second springing of the young plants might be too much forwarded, and, on the other, the plants might be unable to ripen their wood before the ensuing winter. Before the beginning of that season, the seedlings should be covered with dry leaves, to the depth of about a foot; and it must be spread in the interval of

the lines of plantation, in such manner that the seedlings be buried, as it were, under the leaves, and but little be perceptible above the ground. Such a covering acts most beneficially upon the seedlings, especially in great frosts without snow, when the ground becomes contracted, splits, and cracks; then the cold, penetrating through the interstices, injures, and sometimes destroys, the tender root. A fat soil of clay is the most liable to this danger. If the seedlings have not grown to much height, nor very close together, during the first summer, they must be kept two summers longer, after the method that has been described, and be covered again in the winter with dry leaves. But, if they attain the height of one foot, or a foot and a half, or if they have grown very near to each other, they ought to be thinned and transplanted in the second year. This will prevent the loftier from injuring the smaller trees, and the roots of the latter from spreading too much, which would become the more hurtful to their further growth, as they could not be transplanted before the third year after their sowing. But it might be still more advisable to uncover, carefully, the beds, and to take up the seedlings, without, however, breaking the roots, and to divide them in two classes, according to their size. The stems should then be cut as far as they are damaged by the frost, so as to remain about three inches above the surface of the ground, and the root should also be shortened somewhat. The ground having been, in the meanwhile, laid out in seed beds, as mentioned above, the tall seedlings should be planted together in one spot, and the shorter ones in another. The former ought to be separated from each other by such distances as would allow them to grow undisturbed for some years, viz: on a ground four feet wide, in three lines, at the distance of one foot and a half from each other. The smaller plants might be placed six inches apart, in four or five lines, on a ground four feet wide: and this, from the consideration that, should they be again too near one another, in the second or third year, it would be easier to thin them, and to remove a part to other beds, without injury to the others.

The roots of a plant of one year being yet delicate, it will be better to put them in the ground with a planting stick, along a line, than with a shovel. They should be planted a little deeper than they had been before: for a mould recently stirred sinks somewhat, and the seedlings would, therefore, be too high above ground. They should be watered as soon as they are transplanted, in order to bring the earth in closer contact with the root. These beds must be managed, during the summer, like the seed beds, viz: they must be cleared of weeds, and watered in dry weather, and, before the winter comes on, they must be covered again with dry leaves, which are to be removed in the following spring. Before the seedlings begin to bud, all the wood affected by the frost must be cut off, and the ground ought to be carefully opened and stirred, without injuring the roots of the seedlings. The same is repeated the third summer, with the exception of watering. In observing this method during the above-mentioned space of time, the young mulberry trees will gain strength, and, after three years, be

fit for hedges. But the plants designed to become standard trees, for which purpose the handsomest and straightest stems should be selected, must be planted anew, in lines, two or two feet and a half asunder, after having been pruned as above directed, and must be well watered. They are then left to grow seven or eight feet in height; the lateral branches along the main stem are shortened, so as not to leave more than two or three buds, which finally are nicely trimmed in the ensuing spring: for, as long as the branches remain small, and but a part of the sap is necessary for their nourishment, the stem grows uniformly strong, thick, and straight, without need of a supporter, and the head developes itself in a fair proportion with the trunk. When, on the contrary, all the branches are lopped off close to the stem, not only the favorable results which have been mentioned are lost, but the places where the cuts have been made, are blighted, and the death of the tree is often the consequence. These plants, when they thrive, should remain in the nurseries until they have grown up into handsome standard trees, and are then transplanted in the spots for which they were intended.

2d. *From Roots.*—When three or four year old trees, that have not well grown, are cut half a foot above the ground, from four to six suckers spring from that part of the old trunk which is next to the ground. They take root; and, that they may do this more quickly, the mould should be heaped up on both sides of the trunk, and the beds should be hoed in the middle of the summer, and should be watered diligently in dry weather. In following this method, young plants may sometimes be separated successfully from the old roots; and if this be done, after the second year is elapsed, the stems are still handsomer and stronger. In this case, all the trees should be pulled up, the young sprouts should be nicely lopped or torn from the old trunk; and, if the latter is yet serviceable, it might again be put in the earth for the same purpose, or, if not, thrown away. The pruned roots must be properly cut, and may be managed like the seed plants that are two or three years old, and used in different ways. This is consequently an additional method of increasing the number of mulberry trees.

3d. *From Layers.*—Such an increase is further assisted by layers. Whilst in the spring the sap begins to rise, the branches of low trees may be bent down to the earth, or young and elastic stems, well provided with branches, may be bent and fastened down with hooked pegs; the branches are then buried in the ground, where they also should be fastened; or several young stems fit for this purpose may be placed in the earth obliquely, that they may be bent with more ease and safety, and all the branches are then laid under ground, as above directed. The ground around the mother trees should be prepared in such a way that the water may run off. Great care must be taken in bending the stems or the main branches, as well as with the laying down of the smaller branches, to prevent their breaking. As soon as the layers have put forth roots, which often happens in little more than a year, they may be separated from the mother tree in the

ensuing autumn or spring, and taken out from the earth; but this must be done with great care, to prevent the young roots from breaking; and the further process is the same as prescribed in regard to three year old seedlings.

4th. *From Cuttings.*—In this method of raising mulberry trees, use is principally made of the two year old branches, procured by pruning the standard trees, or they are for this express purpose cut from sound and well grown trees, even if no more than a year old. The branches are cut in equal lengths, from ten to twelve inches; and they are thus placed into the ground, prepared for the purpose, at a distance of three inches from each other, and so deep that the branch rises above the ground not more than three inches, and the mould is pressed around it. It should then be watered, and the bed should be levelled. A bed four feet wide is sufficient for four rows of such plants. The cuttings must be frequently watered in dry weather, with a view of hastening the formation of roots.* As sometimes but half of the cuttings succeeds, the ensuing spring should not be permitted to pass, without placing others in the room of those that have failed, or without placing some that are already furnished with roots. The space which the uprooted cuttings had occupied, may also be left empty, whereby those that have thriven will more easily put forth their shoots, if the proper care and management have been observed during the first year's growth of the seedling.

These are the four methods of raising and propagating the white mulberry tree. The first is the most proper for the raising of beautiful and durable trees, and of standards; and the other three furnish only plants fit for hedges—from which, however, much profit is also derived.

§ 53.

e. Of the grafting of Mulberry trees.

Bonafous observes that there is yet a difference of opinion in regard to this method, as some think it advisable to graft the young trees, whilst others prefer to leave them in their natural state.

It must, however, be admitted that the grafted ones lose none of the properties inherent in the wild mulberry raised from the seed, and that it is improved and variegated by the grafting. It is farther to be observed, that, upon the discovery of a finer sort of mulberry, the grafting alone is able to communicate its qualities to other trees, and to procure better leaves.

It is not an unessential precaution to give to all the silkworms food of similar quality; and grafting, only, can render all the leaves equally good. The best methods of grafting mulberry trees are the *pipe grafting* and *the budding*, (*en flute ou chalumeau, ou en écusson à la pousse.*) The latter is quicker done, but the other agrees better with the sprouts, being less exposed to strong winds. The budding rarely

* Several very successful trials of this kind have been made, within the last year, in the garden of the Agricultural Society.

succeeds with mulberry trees. The pipe grafting is as follows: you make a circular incision through the bark, and slip it off, and you substitute for it the bark of the tree from which you graft. If the cylinder which you mean to put on is too large, you must cut it until it fits exactly the part in which you intend to place it; and if it is too small, an additional piece must be cut from the same branch, with, if possible, one bud upon it, and it must be secured by the ordinary mode. The budding is done by taking off a bud, with the bark, as soon as the tree is in sap, and by inserting it in the opening which has been made in the tree intended to be grafted. The most essential thing in this operation is to effect the closest contact between both barks, in order that their tender edges may be closely united. You may also employ *crown grafting*, [*la greffe en couronne*,] after the mode usual in Lombardy. It might be conveniently resorted to for crooked hedges, or such as have been injured by animals. Young mulberry trees, the diameter of which does not exceed two inches, are cut near the ground, and are thus grafted. Within the first year, they produce handsome sprouts, which again clothe the hedges. Persons well acquainted with the subject, advise also to graft young mulberry trees, where they were sown: for, if they are carried afterwards into nurseries, they produce plants equal in strength and growth. But if, on the contrary, they were only grafted in the nurseries, it often happens that those the grafting of which has failed, must be grafted again the following year, and that they are shaded and injured by the adjoining trees that have succeeded better. Those who do not follow this method, ought at least to graft the young trees in the nurseries, and not when they have been placed in the spots for which they were designed, because they can be better tended in a small space than where they are dispersed. While in the nurseries, they are, besides, still of a suitable age to be *grafted near the roots*, (*au collet des racines*,) which method is better than the *grafting upon the branches;* but this cannot be done so safely when the trees are planted out, because the sprouts near the ground might easily be injured.

In the second spring after the sowing, as soon as the buds begin to swell, the grafting branches must be cut from the best trees, and the best are those the buds of which are handsome, and close to each other. To preserve them, they must be in fresh, moist earth, in a northerly situation, and two or three buds are left above the ground. As soon as frosts are no longer to be feared, these branches are engrafted upon young trees which are about 18 lines thick, after the stems have been cut off as near as possible to the ground. Rain and winds being injurious to the graft, the finest weather should be selected. But, if the plants are yet too feeble in the second year, they must be pruned, and the grafting must be postponed till the next spring.

The experiment of grafting has not as yet been made with wild mulberries. Some recommend the *Prunus Mahaleb*, which Duhamel generally proposes for the improvement of all fine stone fruits. But the question is, whether the silkworms can feed upon the leaves without injury? Several trials should be made.

§ 54.

f. Of the form of a Mulberry Plantation.

There are two methods of planting the young mulberry trees, or of forming large plantations, viz: 1st, in *hedges;* or, 2d, as *standard trees.*

1st. *The planting in hedges* affords the advantage that the leaves can be immediately employed for the feeding of the worms, because their vegetation is quicker than that of standard trees. To form such hedges, you should take plants two or three years old, or such as are not fit for standards, plant them three feet asunder, after having properly pruned the branches and the roots, and keep them from five to six feet above the ground. The leaves ought not to be given to the worms during the first two years, but should be left untouched; but the young plants must, at the same time, be kept clear of weeds, and well watered in dry weather. In the spring, the dead branches ought to be pruned from the living wood, with sharp hedge shears, and it should be endeavored to give a certain form to the hedge by such yearly cuttings. Another method of planting hedges, consists in placing plants, two or three years old, at a distance of one foot and a half or two feet, taking, however, care that the two lowest buds be in the direction of the line; and the plant should be cut down to these two buds, about half a foot above the ground. In the course of the summer, they will become two beautiful mother branches; and, in the ensuing spring, one of these is to be pruned down to one foot, and always upon only one side of the plant, be it the right or the left side; and the branches of the opposite side must be left untouched as far as they remain green. These latter branches are then bent in the direction of the hedge, towards the lopped branches, and fastened to them with willows, so as to form an arch.

In this year, the third of the plantation, a multitude of branches shoot out along the mother branches, which must be trained on both sides, in order that the hedge may be brought into a regular form. If the branches are too young, it will be better to cut them only in the following spring. If any stem should die, it must be replaced by another, to prevent a vacancy in the hedge.

The leaves can be pulled for the nourishment of the worm in the third summer. Such a mulberry hedge might also serve as a fence for gardens, meadows, and so forth, and be substituted for hedges of barberries, wild roses, &c. &c.; but, as has been said at the beginning, the situation and the soil must always be taken into consideration.

2d. *Standard plantations* can be formed in several ways; either by a regular or irregular distribution, or they may be formed in hedges. In the former case, they ought to be at least 18, 20, or 25 feet asunder, in order that the trees might spread freely on all sides, and that the ground might be used in some other way; experience demonstrating that the shade of mulberry trees does not injure the field or

garden plants which grow amidst them. If the standards are to be formed in hedges, they are to be placed within the hedge; from 24 to 24 feet a standard is planted, and, in the space between, seven lower trees should be put; or, if the standards are 30 feet from each other, which is still better, nine of the other sort may be put between. The standard must then be eight feet high, so that its branches may meet those of the adjoining smaller tree, and they may live simultaneously, and share together, undisturbed, the salutary influence of the sun, the dew, and the rain. Such a plantation is preferable to that of the other kind, by affording not only an earlier but a more abundant crop of leaves: for the worms may be fed, in the first period of their life, with the leaves of the hedge, and in the second with those of the standards; whereby neither of the trees would be too much exhausted, and might be serviceable during the whole year.

The preparing of the soil must be carefully attended to, in both methods, previous to the plantation. This must be done before winter, not only on account of the reasons already stated, but also with a view that the labored earth might sink to its proper level during the winter. In spots where mould is not in sufficient quantity, there must be gathered enough of it to have it at least three feet deep: for the trees would not thrive in a shallow ground. The ground ought, therefore, to be divided, in the autumn, into regular lines, and the places where a standard is to be placed ought to be marked with a stick, around which a circle of about eight feet in diameter should be broken up, down to bad ground or gravel; and, if the mould lies deep enough, it ought again to be thrown up, in order that the upper part, or the turf, should remain at the bottom of the mound. If there be so little mould, if for instance it be no more than 12 or 15 inches deep, about a foot more of gravel must be thrown out, and replaced with good earth, and the mound must be raised a foot above the general level, in order that the tree, which is to be planted, be at least three feet under ground. If the digging out of the gravel were to be omitted, on account of the expense, the deficient mould, if the ground be not too shallow, may be laid upon the surface; but a mound raised in this manner must be at least ten feet in diameter and three feet deep. But this method cannot be much recommended, from the danger of the dryness, heavy winds, &c. &c. It is also advisable to keep them clear of grass. For the hedge plantations, the ground should be broken up five feet wide, and to the whole depth of good earth; or you may dig, where the mould is wanting, a trench five feet wide, and from three to four feet deep, and fill it with good earth; and, if the earth of the mound, as well as of the trench, have sunk too much, fresh earth must be thrown up to raise the ground to the proper height. The same method is to be observed, as has been mentioned already, in planting, and the trees must be well watered as soon as put in the earth.

If the standard trees are not strong enough, or if their heads are too large to stand without support, stakes ought to be fixed close by, to which they must be fastened with willow: and it will be well to do this before planting the trees. It must, however, be observed, that

they must be fastened loosely, in order that, in case the earth should sink, they might have space enough to follow gently that movement; because, otherwise, they would come to stand above ground, and their roots would remain naked. Care must also be taken not to rub or injure the bark.

§ 55.

g. Of the conservation and further management of Mulberry Trees.

In some countries the grown up mulberry trees are left to themselves; in others, they are more or less pruned. Both these mothods are more founded upon custom than upon sound principles of rural economy. Three things ought to be kept in view:

1st. The quality and the quantity of the leaves.

2d. The duration of the trees.

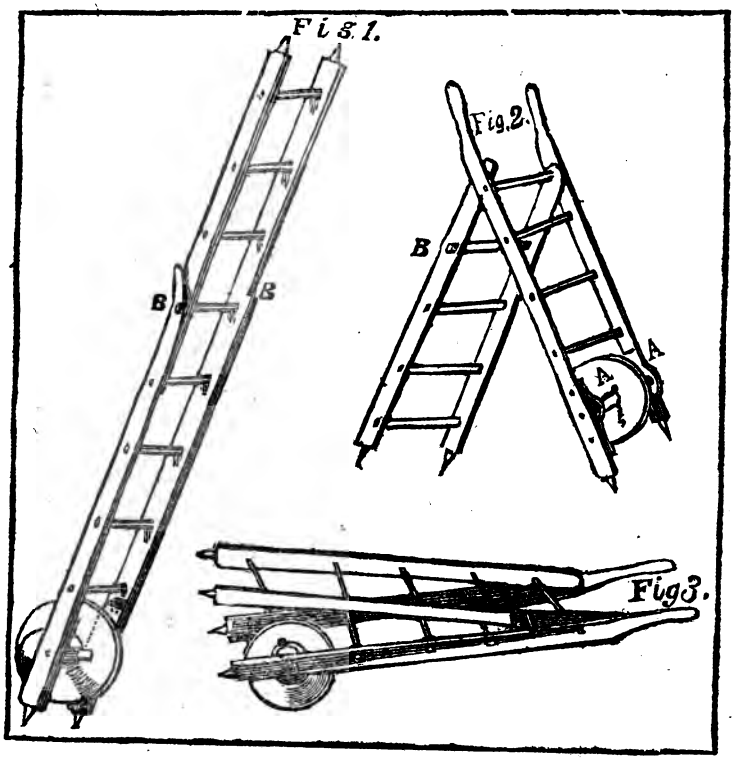
3d. The facility, and the certainty of the gathering of the leaves.

Any method adopted, without regard to these primary conditions, is dangerous or useless. The clipping of the trees contributes undoubtedly to render the leaves more numerous and larger; but, if it be done at an improper time, or imperfectly, the leaf not only becomes less nutritious, but diminishes in quantity. We shall not, at any rate, recommend the method sometimes adopted, by which the lateral branches are cut every three or four years, leaving the principal ones alone. The leaves may thereby become larger, and the crop more abundant; but the worms will have a poor food; the trees lose their strength, in proportion to the number of their wounds; their natural growth is checked, and their life is shortened. Trees left to themselves have a thin foliage, the leaves are small, and it is difficult to gather them. A blunder committed in the pruning might destroy a tree, but the cutting, itself, is not necessarily hurtful. Much caution must be observed with the pruning, in the first year that the leaves are plucked, and the pruning must be executed, so that, by an equal distribution of the sap, there may be a perfect equilibrium in all parts of the tree. Consequently, after the gathering of the leaves, all the branches that had been damaged in that operation, and all the dead ones, ought to be lopped off, as well as those the vegetation of which seems too low; and those the vegetation of which, on the contrary, is too luxuriant, ought to be restrained in that propensity, or trained in an oblique direction, which is a means of restraining a too rapid growth: the tree ought not to be left to grow to an excessive height, nor to spread too far; the branches which obstruct the development of the head, or hang too much down, should be shortened; and, lastly, those that have been thrust out of their natural direction, during the gathering of the leaves, ought to be set right again; and, for the rest, the ordinary treatment of fruit trees must not be lost sight of.

The precautions recommended here, in regard to trees, are applicable also to hedges, as has already been premised in § 54.

h. Of the pulling of the Leaves.

Much depends, in regard to a long preservation of mulberry trees, and mulberry hedges, on the method of gathering their leaves. It should be done with the greatest care, to prevent the trees from receiving injuries: and caution is so much the more necessary, as nature has not intended they should be stripped violently of their foliage. It is essential that *all* the leaves should be pulled off: for, if any remain on some branches, they attract the sap, whilst the naked branches are incompletely nourished. Begin by pulling the leaves of the hedges; then proceed to the young trees, whereby the latter gain time to come into fresh leaf, and the sooner, in proportion as the leaves of the older trees are more fully grown, and more nutritious. These are the most proper for the worms. The stripping of the leaves should not be begun before the disappearance of the dew, and ought to be concluded before the setting of the sun. The hand should move from below upwards, in order to avoid pulling off the buds, though it would be easier to strip them in the contrary direction. All climbing upon young trees must also be avoided: for their branches are tender, and break easily; the best way is to use the rolling ladder, of which we give here the design.



It consists of two parts: a wheelbarrow, the legs of which are from seven to eight feet long, straight, somewhat projecting beyond

the wheel, and connected by four cross sticks; and a ladder six feet long, which is attached to the wheelbarrow by the fourth cross stick: with this apparatus, a single man is able to carry several bags of leaves. It forms, when only half displayed, a double ladder, as it is used in pulling the leaves, for the tree must never be rubbed; when displayed in its whole length, it is like an ordinary ladder, from 12 to 13 feet long. The pointed iron, with which one end of each of the legs is shod, serves to give to the ladder a steadier position. This apparatus may serve besides for every other sort of fruit trees.

The bags should be hooped, in order to remain open, and ought to have a hook, that they might be hung on the branches; care must be taken that the leaves do not fall on the earth, and that the bags be not emptied on the ground, especially when it is not very clean or clear of dust; when conveyed on the wheelbarrow, they ought to be kept sheltered from the sun. Leaves covered with a tough, viscous matter—the honey-dew, as it is called—are injurious to the worms; they must be used only in case of great scarcity, and must then be carefully washed and dried. Rusty leaves have not this inconvenience, because the worms eat only the healthy portion. In some countries, mulberry trees are stripped of their leaves, in the above-mentioned manner, to procure food for the cattle: this is a very bad custom; such a double tax upon these trees, exhausts, and soon destroys them. The best method to preserve them, and to keep them long in leaf, is to leave a portion of them untouched every four or five years. As it is all-important to have always a supply of dry leaves, and as rains sometimes continue long, it will be well to have some trees under shelter: to this end fasten three or four hop sticks loosely together, above the tops of the trees, in form of a pyramid, so that they are from six to ten feet apart, upon the ground; on the top fix three or four hoops of a size corresponding to that of the tree, and cover them with straw, as in thatching a house. You obtain, in this way, a light, cheap, and moveable roof, which will preserve the trees from the rain. With a provision of such roofs, you can quietly wait for the rainy season, and be sure to have always wholesome and dry trees. But there are means of drying leaves which cannot avoid becoming somewhat moist in consequence of a continued rain. Spread them in parcels on a clean linen cloth, in a dry room, stir them often with a rake or a fork, shake the cloth, and the leaves will soon dry. Dusty leaves must be cleansed with clean linen.

§ 57.

i. Of the other advantages that might be derived from the Mulberry Trees.

The fruit can be eaten, (the white less than the black,) and converted into sirup or vinegar. As the wood resists moisture, it can be advantageously used for pails, hoops, casks, and all sorts of turner's and joiner's work. Paper, and fine pack and sewing thread

can be manufactured from the bark, and the leaves furnish good food for sheep and goats.

§ 58.

k. Of the enemies of the Mulberry Trees, and a protection against them.

The principal enemies of the mulberry trees, are hares, deer, and mice. In places where these animals exist, it will therefore be prudent to cover the trees, before the winter, with straw, reed, or sedge, and to leave this covering until danger is no longer to be apprehended; and, in the mean time, it will shelter the trees from the frost, if it is extended to the head. It may be useful, even in the summer, especially if the trees stand in a sandy soil, because it prevents the rapid evaporation of the sap, and preserves longer the refreshing dew. The nurseries must be particularly defended against the danger of which we speak. They should, therefore, be raised in close gardens, or be surrounded by a tight fence. Against mice the usual remedies might be resorted to; and if, notwithstanding all these precautions, the trees are injured, either by mice, hares, hail, or an unskilful plucking of the leaves, and the branches or the bark have been hurt, the wounds should be smeared with the cement hereafter described, and dressed with old linen, if the wounds be large, or if the bark be loose. It will be found, after a while, that not only the wounds are perfectly healed, but that the old bark that was broken has become perfectly smooth. The cement is, therefore, an excellent remedy, also, against the canker, blight, and other diseases to which the bark is liable. If they consist, however, in a slow and poor growth, the tree should be cut down to the mother branches, and an attempt should be made to improve the upper mould, (if it be presumed that it contributed to the disease,) either by some old manure or good earth.

I have heard of a species of vermin, resembling bugs, that have been seen, in different years, upon mulberry trees, and from which the leaves became hurtful, and even fatal to the worms; and two remedies have been proposed: to sprinkle the tree with soap-water, or to smoke it with dry ox-dung. The disease arises, perhaps, from mere neglect. The cement to which we referred, is the one invented by Forsyth, and can easily be made: take sixteen parts of cow-dung, (or such as contains no litter,) 8 parts of old mortar, 8 parts of wood ashes, and one part of river sand; the dry ingredients must previously be sifted through a fine wire sieve; the whole must then be diligently worked to a thick unguent. Instead of cow-dung, ox blood may be used; and instead of mortar, chalk. After having thinly smeared this unguent upon the diseased spot, the surface must be rubbed perfectly smooth with a powder, six parts of which must be wood ashes, and one part burnt bones, or chalk. This, however, should only be done in dry weather, in order that the unguent might dry quickly, and cover the wounds with a crust; and, as it does not stand long.

there must not be more prepared of it than is required at a time; but, if it is intended to be kept, it must be moistened with urine. In Forsyth's hands, it became a universal remedy against all the diseases of trees and plants, and he was accordingly richly rewarded by Parliament. Every intelligent gardener in Germany is probably convinced of the efficacy of this remedy.

§ 59.

II. *Treatment of the Silkworms.*

The illuminated plate,* annexed to the present work, represents the series of changes, from the formation of the egg to the death of the silk moth. We shall explain it with reference to the figures that are marked upon it.

§ 60.

1. *The egg, or the development and birth of the Silk Caterpillar.*

The dark gray eggs are yet undeveloped: but the white ones have their worms already hatched; and, for that reason, such a little insect has been drawn close by. Here begins the silk culture: we must, therefore, speak, 1st, of the place where the worms are reared; 2d, of the proper time of beginning the breeding; 3d, of the further preliminary process; and 4th, of the coupling of the moths.

I must, however, previously observe, that till a very recent epoch, every thing was uncertain in this culture, and that Count Dandolo† succeeded, by experiments pursued for many years, in reducing this art to exact principles, and in throwing much light upon it. The culture of silk has thus been reduced into a system, and Bonafous has hence been enabled to publish his second work, entitled *De l' éducation des Vers à Soie:* Paris, 1821. By means of that work, combined with the experience derived from the most recent exertions in Munich for the culture of silk, and other data, we are enabled to bring together, in the present pages, in a didactic form, all that relates to this useful art.

a. Persons who intend to pursue the silk culture, upon a large scale, should erect a building after the model proposed in the above-

* This plate was drawn upon a clever exposition of all the parts of the silk culture *in natura*, by the gardener, Mr. Seitz, which he presented to the General Committee of the Agricultural Society.

† He made these experiments upon his estate, Varese, near Milan, where he opened a real school for the silk culture, and where he gathered around him some young men, to whom he read lectures on this art. We refer the reader to the Count's work, entitled *Del arte di governare i bachi da Setta*, del Conte Dandolo: Terza ediz. Milano, 1819. The Count died the 12th of December, 1819. His laboratory still exists at Varese, and has been imitated in several places. It is indeed a perfect model: the Italians call these laboratories *Dandolieres*, from gratitude to the person through whose instruction the crops of silk have been increased tenfold in Italy, and who has secured to his country an abundant source of wealth.

mentioned work. But, as I have repeatedly said, I mean only to speak of the *popular pursuit* of it, as the incidental occupation of females of all ages, of children, and of old and poor people, and which, nevertheless, produces great results, as well in regard to the number of worms that would be reared, as the fabrication of the silk.

This popular pursuit requires no express buildings or institutions, which never fail to be expensive, and which, like military barracks and hospitals, never thrive. I speak of the culture of silk as an incidental occupation, which can be pursued in ordinary rooms; and the Agricultural Society had no better laboratory for it than their public office. But the rooms ought to be dry, and sheltered from the extremes of cold and heat; as the worms dislike dark rooms, they ought to be sufficiently lofty and light. The windows should be left open, when the weather is fine, to refresh the room; but never when it is windy, or when it rains. Air holes of 12 inches square, with moveable slides, will be very serviceable, and they ought to be made near the top of the room, or under the windows, or at the doors, near the floor. The exterior air penetrates through the lower holes, and carries off, through the upper openings, the air, which before filled the rooms. The number of these holes must be proportioned to the size of the rooms. Experience shows that this is the best means of renovating the air of an enclosed place; and, in order to keep it, in general, as pure as possible, there ought not to be too many worms in a single room—their perspiration being very great, and, consequently, the medium in which they live is soon affected by this cause. According to their numbers, there ought to be two or more rooms. An eastern exposure is the most eligible, and a northern is less proper, on account of the cold.

b. Respecting the beginning of the culture, or the time at which the egg is taken from the cool place, where it was kept, and brought, for its development, into the room allotted for that purpose, the rule is, that the leaves of the mulberry tree must have just put out; for the first leaves are, if we may be permitted to say so, the milk of the forthcoming worm. The temperature must have risen to 14 degrees (63° 5 Fahr.) Therefore, in Munich, for example, the proper epoch is at the end of May. The worms then come forth in the first days of June. The calculation may be extended to the several districts of the realm, upon a comparison of their mean temperature with that of Munich. In Regensburg, for instance, the process will begin from eight to ten days, and at Wurtzburg and on the banks of the Rhine, from fourteen to eighteen days earlier than at Munich.*

c. The further preparations consist in placing a stove in the room destined for the worms: it ought not to be of iron. We had, however, none of any kind in the room of the Agricultural Society. If

* Mr. De Turk assigns, perhaps, the proper moment rather too early, in fixing it for Prussia at the middle of May. His memoir contains, nevertheless, many useful details. Another little work, entitled "*The Culture of Silk*," by George Lilla: Nordhausen, near Landgraf, 1826, is rather too summary, and will afford little instruction to the practical rearer of silkworms.

there be a fire-place, it would be well to burn in it small pieces of wood, by which the air will be purified; and the advantage of a chimney is, that it can be resorted to whenever you wish. It can, therefore, be considered as a substitute for the stove; but, in neither of them, ought oak nor turf to be burned. It is advisable to have a thermometer to regulate the temperature.

Sudden changes of the temperature always injure the worms; but they suffer less when the mercury falls one or two degrees, than when it rises high. Generally speaking, the cold is not hurtful to the worms, but it delays their development. Yet the cold acts injuriously upon them when they are near or in their sleep, or when they approach their maturity, or have already attained it; because it then destroys the silk substance enclosed in their delicate vessels. The proper heat exercises a great influence upon the fineness and quality of the silk. If a too high temperature cannot be avoided, no fear need be entertained, if there be a free circulation of the air, by means of the air-holes, as well as of the doors and windows. But, if the interior air is too stagnant, it can be renovated by lighting a little fire in the chimney. The country people, who rear silkworms in Italy and France, always keep a thermometer in the rooms where they have the worms, on purpose to observe the changes of the temperature, and to regulate it. Such an instrument costs not more than 20 or 30 kr. It will be well to have two thermometers, and to place the one within the room, and the other without, to ascertain exactly the difference of the two temperatures. An instrument, invented by Mr. Bellani, of Como, called a *Thermometrograph*, deserves to be particularly recommended to silk cultivators, because it indicates the maximum and minimum of the temperature of the rooms, where the worms are reared, whilst the rearer is absent. The following design, in which the instrument is drawn in proportion of half its real dimensions, will give a precise idea of it:

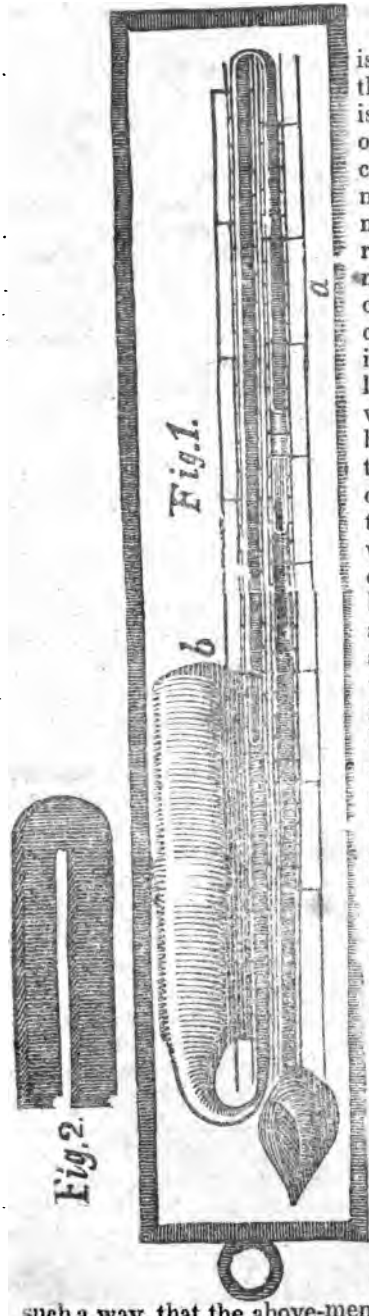


Fig. 1.

Fig. 2.

A glass tube, the diameter of which is thrice as great as that of ordinary thermometers, and the length of which is regulated upon the number of degrees of temperature which it might be necessary to ascertain, is fixed on a varnished board. The tube is in the middle, curved, so as to form two parallel branches, one of which terminates in a long, vertical, and hermetrically closed ball; and the other in a cylindric vessel, the diameter of which is equal to that of the ball, and the length of which is about ⅓ of the tube's whole length. Nearly half of the branch is filled with mercury, and in the upper part is alcohol, in sufficient quantity to fill the rest of the tube and the cylindric vessel, but not the ball, which remains empty, in moderate degrees of heat. In each of the branches, lies, upon the quicksilver, another much smaller tube, nearly half an inch in length, the upper part of which is closed, by means of a soldering pipe, and the other with a disc of black enamel. In this small tube is enclosed a needle of steel, and, at one of the extremities of the tube, is attached a single hair, either of man or horse, which is stretched out the whole length of the tube. In this manner, the internal tubes, which contain the steel needles, can be raised, without obstruction, by the mercury, and remain, by means of the elasticity of the hair, suspended at the side of the external tube, when the mercury falls. The inferior extremity of the needle shows the degree of the temperature, or the point whither the quicksilver has pushed it.

To make the division, it is sufficient to put, successively, the cylindric vessel, filled with alcohol, in pounded ice, and in boiling water; and to try it, the needles must be brought to fall in such a way, that the above-mentioned disc should come to lie upon the mercury. A magnet should be used for this purpose, of the form of a

horse-shoe, as in fig. 2; the poles must be channelled out, so as to embrace the external tube.

The scale of division is engraved on both sides of the board, but in an opposite direction, and after the following manner:

Marked on the left side, A, 10 degrees of cold, between the point determined by the melted ice and the inferior bent of the tube; and from the point zero, which indicates the point of congelation, the distribution of the degrees of heat is continued until the 35th degree. On the right side, B, you make the division in an opposite direction; because the quicksilver, falling in the left branch to the point of congelation, rises in the right branch of the tube, to the height marked zero, and, above this point, are marked the degrees of cold, and below, the degrees of heat. Thus the mercury cannot fall one degree in one part of the tube, without rising one degree in the other, and vice versâ. The needles remaining at the most elevated point where they have been driven, indicate, the one the maximum of heat, and the other the maximum of cold.

In transporting this instrument from one place to another, care ought to be taken to keep it in a vertical position, to prevent the mercury from mixing with the alcohol.

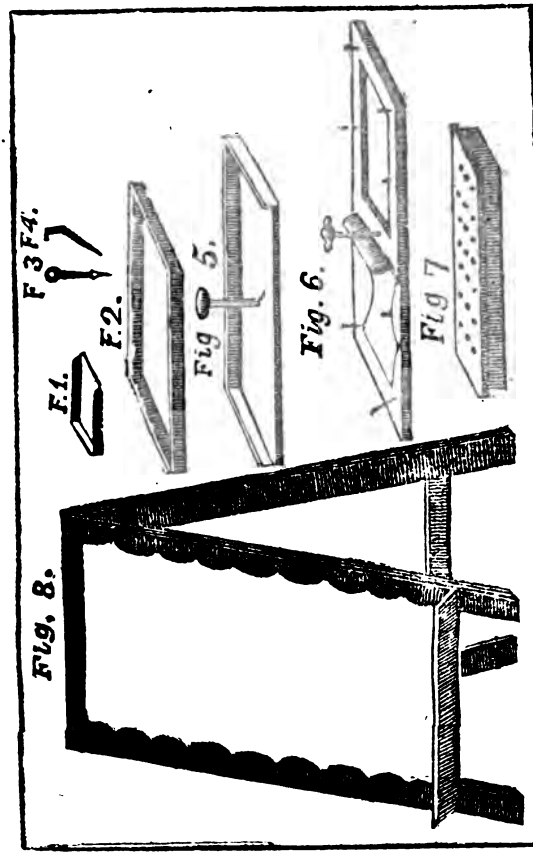
It will also be advantageous to have a hygrometer in the room: an instrument which costs but a trifle. The best are made of catgut. If the humidity exceeds 65 degrees, the atmosphere becomes very injurious to the worms. In default of a hygrometer, you may keep, in an earthern plate, upon the table, some common salt, which, by becoming moist, indicates the same hurtful state of the atmosphere. Long experience shows that nothing is so dangerous for the worms as an excessive heat, or an excessive humidity.

In the middle of the room should be a table, upon which you lay the paper with the eggs. There are two methods of promoting the coupling of the caterpillars: either by extending them on a linen cloth, or on sheets of paper, as we shall hereafter describe at greater length. In the former case, the removal of the eggs requires some attention, which Bonafous describes as follows. You carry the linen cloth, with the eggs, into a room, the temperature of which is equal to that of the place where the eggs had been kept during the winter; the cloth is put in a tub of water, for five or six minutes, and is afterwards left dripping in the hands, two or three minutes. After this, it is laid upon a table, and the eggs are detached with a fine scraper or a quill. The eggs are put again in a water vessel, and softly rubbed with the hand. The water, with the eggs, is afterwards thrown upon a sieve, or a linen, to let off the water. The eggs are then removed, and are put, with those that have remained at the bottom of the tub, in a basin; fresh water, and light red or white wine, are thrown upon them. The eggs are then to be gently washed anew, and, the water being let off, they are extended upon a dry and clean cloth, and when they are quite dry they are put upon a plate or upon hurdles to hatch. This, however, as I have already said, is not necessary, especially if the eggs lie upon paper; each sheet is put in a larger one of paste-board,

or a thick paper, all the edges of which are turned up two or three inches, and which repose on a stand of laths, in order that the heat might act from beneath upon the eggs; and they are then left in an exposure to the sun, but out of its direct rays. On the first day, the heat ought to be 14° (63° 5 Fahr.) You can also raise frames, fitted up with strong linen, and which are laid upon a small stand.

From the time that the worms change their first skin, until the moment that they begin to spin their silk, canes, placed close together, would be of great use. They are not expensive, for all that is required are canes, or reeds, and packthread. They last several years, and can be preserved, rolled together, without occupying much space. They agree well with the worms, which thus enjoy the air from above and from beneath. But even this cheap apparatus can be dispensed with. The culture of silk has been carried on, at first, by the Agricultural Society, by Mr. Wurz, and by some other individuals, by means of ordinary sheets of paper, which were afterwards put, together with the worms upon shelves, where books or documents had before been lying; and when the worms grew larger, in the process of time, and accordingly required more space, more paper sheets were put.

Although these preparatory measures have proved sufficient, in the experiments tried by the Agricultural Society, as well as in those instituted by Mr. Würz, it may, however, not be useless to mention some of the instruments recommended by Mr. Bonafous, for a culture upon a great scale. The designs of some of them are given; the others will be understood from description.



a. The *Scraper:* an instrument much like the one which serves for scraping the dough from the brake. It serves for detaching the eggs from the wet linen cloth; but the edge of the blade must be neither too sharp nor too blunt. (fig. 1.)

b. Bandboxes for the hatching of the eggs.—The smaller ones are made of pasteboard, and the larger ones of thin board. Five square inches, at least, must be reckoned for an ounce of eggs. The boxes must be lined with paper; and, on the sides, the weight of the eggs should be marked, that it may always be exactly known how many eggs each box contains. (fig. 2.)

c. A Tin Spoon, nearly of the form of a spatula.—It serves for stirring the eggs when the worms are near being hatched.

f. A Prick Punch.—This tool is made in such a way, that, upon the first stroke of the hammer, the paper is instantly perforated in several places. The holes must be sufficiently great to leave a passage to the worm, when it is just hatched; and, as soon as the worms are in life, these papers serve to separate the shells, and to take them from the

boxes. To render this easier, four cords are fixed crosswise on their edges, and are, at proper distance, bound up in a knot, in form of a small hook. This instrument is a crooked iron, by means of which you may easily lift from the bandboxes the smaller branches, covered with worms, and lay them upon the hurdles: for, in touching them with the hand, these delicate little insects might be injured. (fig. 4.)

f. The Hurdles.—They are put against the wall, at the distance of about one inch, and upon a stand. Their breadth should generally be from 30 to 32 inches, and their length fron 9 to 12 feet. They are put above one another, 22 inches asunder. The hurdles are edged by laths, four inches long, which serve to support the small portable trays. The canes, of the hurdles' bottom, are an inch distant from one another, and are fastened with twine to the cross-wood. They may also be made of any branches or brush-wood. The canes must be somewhat asunder, to let the air be in contact with the paper with which the hurdles are covered, and to dry it the quicker.

g. Small portable Trays.—These are, thin boards from 12 to 14 inches in width, and sufficiently long to fit across the breadth of the hurdles. A handle is fixed in the centre; and the trays must be very smoothly finished, that the worms may lie upon them without difficulty They have then their side ledges about half an inch deep. (fig. 5.)

h. Travelling Case.—This is very convenient for transporting the insects about. It is like a medal box.

i. Knife, to cut the leaf small.—It must be kept clean, and never be used for any other purpose.

k. Double Chopper.—It has two parallel edges, and is much like an ordinary kitchen chopper; it is used after the leaf has been cut with the knife.

l. Large Chopper, which is made somewhat like a straw cutter. A great quantity of leaves can be cut with it in a short time. It is therefore very useful for the silk culture on a large scale.

m. A Spatula of metal, which is turned up at three sides.—It serves to clean the papers of the hurdles, principally when the worms are in their last ages.

n. Square Baskets.—They should be very wide, and shallow, with a hook fixed to the handle, that they might be easily hung on the edge of the hurdle. They must be kept very clean. From these baskets the leaves are distributed to the worms.

o. Small hand Birch Broom.—It serves to spread the leaves evenly upon the hurdles.

p. Frames for placing the worms upon.—They are covered with linen, which may be changed when dirty. The handle facilitates the transporting them. (fig. 6.)

q. Boxes for keeping the moths in.—They have air holes in the sides, and serve to keep the moths from light, without injuring them, and to prevent the males from flapping their wings. (fig. 7.)

r. Stand.—It shuts up, and takes up no room. The linen is spread on it, upon which the eggs are gathered. (fig. 8.)

s. Frame.—This is a small frame, provided with thread. The linen cloth, containing the eggs, is stretched out upon it, and they thus remain, on all sides, in contact with the air, and keep fresh and dry.

§ 61.

1.—The coming forth of the moth offers the following particulars: In Italy and in the South of France, young girls carry the eggs in their bosoms, and hatch them by their natural heat. In other countries, this is done by means of manure or hot-houses. But it is proved that a too sudden and too great heat is rather noxious than useful; and it is better to leave time for the eggs to be hatched gradually.

Bonafous rates the period of hatching from ten to twenty days only, and requires for the first two days, 14° (63° 5*;) for the third, 15° (65° 8;) the fourth, 10° (68° 0;) the fifth, 17° (70° 3;) the sixth, 18° (72° 5;) the seventh, 19° (74° 7;) the eighth, 20° (77° 0;) the ninth, 21° (79° 2;) the 10th, 11th, and 12th, 22° (81° 5.) † He recommends to stir the eggs in this interval of time, once or twice every day. When they begin to assume a whitish color, it is a sign that the worm is formed. It will then be proper for the eggs to be covered with a veil, or with paper, and to spread around leaves or small branches of mulberry. Most of the worms will come forth in the morning.

If the air be too warm or too dry, a basin or two of water may be placed upon the table, whereby the air will be improved and the hatching promoted. Experience shows, besides, says Bonafous, that those worms which come forth in the last days, are the strongest and healthiest; and he accordingly advises to destroy the earliest. To have them of the same age and size, the first hatched should be fed less, and the younger and later ones somewhat more. The old ought to be kept separate from the young, in order that, afterwards, all the worms may be fed to the same degree. Their health may be known by their color, which must be neither red nor black, but dark chestnut.

It ought not to be neglected to have eggs in reserve, or kept in a cool place, that if, by accident, the hatched eggs should be damaged, or a sudden frost should spoil the leaves of the mulberry tree, whereby the worms would remain without food and perish, a new trial might be instituted with the eggs that had been preserved.

§ 62.

2.—*The Silkworms during the first age, till their first moulting.*

This is the first period, and like the childhood of man. Every thing depends then on the nourishment and the manner of tending the

* Fahrenheit.

† I have just read in French newspapers, Mr. Bonafous' report on his culture of silk, during the year 1825, on his estate near Turin. He had prepared for hatching three ounces of eggs, on the 30th of April, which is, for Italy, the proper epoch. The hatching lasted eleven days, by a temperature from 14 to 20°, (from 63° 5 to 77°) until all the worms were hatched. The first age of the worms took five days, the second four, the third seven, the fourth seven, and the fifth six; or twenty-nine days in the whole. The completing of the cocoons required seven days more. He thus obtained very beautiful cocoons, and altogether a very rich crop.

worms. It is now exactly known, from long experience, what quantity of food the worms require in their several ages, until they have begun to spin their silk. A French ounce being equal to 1¼ ounce of Bavaria, we may, on an average, set down half of the quantities which Mr. Bonafous indicates; and twenty thousand worms correspond to one ounce of eggs of our weight, and they require, through all their ages, a thousand pounds of leaves. From eighteen to twenty good mulberry trees give, each, one quintal and a half of leaves, and, consequently, from eight to ten trees are necessary for twenty thousand worms. Every silkworm rearer can thus calculate, proportionally, the number of eggs and trees. In regard to the feeding during the several ages, it is to be observed, that the worms require, in the first age, a hundred and twelve times, in the second age, three hundred and thirty-six times, in the third age, one thousand one hundred and twenty times, in the fourth, three thousand three hundred and sixty times, and in the fifth, twenty thousand two hundred and ninety-six times as much as they weigh in the form of eggs.

On an average, twenty thousand worms require,

In the	1st period, - - - -	5 lb. of leaves.
	2d - - - -	15
	3d - - - -	46
	4th - - - -	139
	5th - - - -	795
		1,000 lbs.

Until lately, twice as much would have been consumed in Germany, in consequence of the many errors which attended the rearing of the worms, their feeding, the economy of the leaves, &c. &c.

During the two first ages, the leaves should be cut very small, either with the ordinary chopper, or with a straw-cutter. The branches and buds ought to be previously separated, so that nothing but the tender leaf may be given to the worms. The leaves must be cut in the third, fourth, and fifth ages, but not so fine. Yet, as has already been repeatedly observed, they must be clean and sound, which will be known from the fresh green color they have when they are so. It will be well, principally in the two first ages, to keep the leaves in a cool place, such as a cellar, that they may remain fresh, and sheltered against the air and the sun.

It must further be observed, that, in the two first ages, the worms should be fed upon such leaves only as have been gathered seven or eight hours previously; but, in the later ages, they ought to have been pulled one or two days before. * In Germany, however, the fresh leaves are preferred at all times, and perhaps erroneously.

* There may be, by chance, a deficiency of leaves, even at the beginning and during the life of the worms, and it may therefore be advisable to devise a means of supplying their place, and to save the worms from dying before the new leaf has appeared. Bonafous and Dandolo may be right to think that there is no other food for the silkworm than the mulberry leaf. It may nevertheless not be useless to mention here the experiments that have been instituted to discover a substitute, were it

The leaves ought to be cut shortly before they are to be eaten. The best method is to let the worms have four meals within 24 hours: the first at 4 o'clock, the second at 10 o'clock, the third at 4 o'clock at night. It was assuredly a great mistake to give the worms two meals only, one in the morning and the other in the evening, as if the worms passed the night in their beds, like human creatures. On distributing the new meal, the leaves of the previous one must be eaten up, and an hour and a half must have elapsed in the interval. The temperature of the room should be maintained at 19° (74° 7) in the 1st age; at 18° or 19° (72° or 74° 7) in the second; at 17° or 18° (70° 3 or 72° 5) in

but to encourage further trials. Mr. Seitz has made experiments, of which he has given an account in the *Weekly paper of the Agricultural Society of Bavaria; year* XV, *p.* 318; and he observes, "It appears from these experiments and trials, that it is not easy to find a substitute for the leaves of the white mulberry tree, so much the less, as even among the different species of mulberry trees, the white affords the best nourishment, and the worms fed upon its leaves produce the best silk. The gummy mucilage, which is peculiar to the mulberry tree, is perhaps the prime matter—the generative element—of the silk, which the caterpillar, during its life, absorbs along with the other nutritious substances, filters and transforms into silk."

Mr. Burgsdorf maintains, nevertheless, that the leaves of Linnæus' *Acetatorium* are much relished by the silkworms; and some other persons think that old or dry leaves can be substituted in place of the fresh, and that there should accordingly be made a provision of them. The worms may, indeed, feed upon them in the latest period of their lives, if, before they are distributed to them, they are moistened and dried anew, because the worms are then very hungry, and not so delicate in the choice of their food; but they will hardly be satisfied with them in their earlier state. Not long ago, the Countess Eleonora de la Porta, of Hiezing, near Vienna, obtained from the Emperor of Austria a patent for feeding the silkworms with dried leaves, to preserve them against the dangers of a total want of food, in consequence of late frosts.

A few weeks since, a gentleman from Sweden assured me, that last year the leaves of the white raspberry bush (*Rubus idæus spinosus, fructu albo*) had been employed with success, for the feeding of silkworms in that country, and had consequently proved a good substitute for mulberry leaves.

It is a striking fact, that, two years past, Mr. de Schrank had already observed to me that, according to his experience, such a substitute must exist. He had, in 1780, some worms, but wanting food, and being much distressed for the worms, he put them in his little garden, thinking that they would, perhaps, find themselves means of escaping death. A few months afterwards he found several cocoons on the gate of the garden. Notwithstanding his extensive knowledge in botany, he could not discover on what species of leaves the worms had fed.

Still more striking is the following information, which Mr. Reichhold, a civil officer in the Grand Duke's service, addressed to the Board on the 19th of April, 1826: "In regard to my former experiments, I will say, that after having failed with the silk moths, I did not care much for the eggs, and I left them in a place where they were exposed, during the whole winter, to the greatest cold. When I found them again in the spring, I thought that they must be frozen. I carried them, nevertheless, into a room, where the worms were hatched shortly afterwards, and were as lively as if they had endured only a moderate cold. But it was too early for the season; for the leaf of the mulberry had not yet made its appearance. By way of experiment, I fed the little worms till their first moulting, upon the tender yellow leaves of the headed lettuce: after this, I gave them mulberry leaves, and reared them thus till they began to spin their silk. They declined a little, but none died. I had besides only one large black mulberry tree; nevertheless, two-thirds of my cocoons were beautiful, white, and close, and one-third of a brimstone color."

In the environs of Lyons, also, silkworms have been fed with good success, till their second moulting, upon lettuce. See *Compte rendu des travaux de la Societe d'Agriculture de Lyon*, 1820, p. 148.

the third; at 16° or 17° (68° or 70° 3) in the fourth; at 16° or 16° 5 (68° or 69° 1) in the fifth age; and at 16° 5 or 15° 5 (69° 1 or 66° 9) towards the latter part of the rearing.

In regard to the space which the supposed number of worms (20,000) requires in the several ages, and in proportion of which the boxes must be enlarged or multiplied, it is to be observed, that 20,000 worms require, on an average, in the first age, five feet square; in the second, ten feet; in the third, twenty-three feet; in the fourth, fifty-five feet; and in the fifth, one hundred and twenty feet square. Upon these general rules, the following will be each day's task, in regard as well to the feeding as to the tending of the worms:

First day.—The four meals require together thirteen ounces* of leaves, which are distributed in increasing proportions. It is advisable to give small portions of food in the intervals of the regular meals, without exceeding, however, the quantity fixed for the whole day. Generally, the worms eat each of their meals in an hour and a half; and they remain afterwards quiet; but they may receive, at intervals, the little supplementary food we have mentioned above. The space must be enlarged on each distribution, and the worms can be laid with a quill in their right place.

Second day.—The four meals require nineteen ounces. The rule of giving at first small portions, and at last the largest, continues to be observed, as on the preceding day.

Third day.—One pound and ten ounces of leaf. The appetite of the worms increases, and the intermediate portions ought not to be neglected. The space must be enlarged, by the addition of nearly one-third of what it was at the beginning.

Fourth day.—Nineteen ounces of leaf are necessary. The first meal must be the most copious, and the following must decrease in quantity. The worms must be at their ease in regard to space, so as not to be one upon another, especially when the torpor approaches, which begins at the end of the fourth day.

Fifth day.—Six ounces of leaf are distributed to the worms that are yet awake. Should this quantity not be sufficient, it may be increased. But in the evening all the worms will be asleep, except perhaps some who have already awoke.

There yet remain, therefore, of the five pounds of food fixed for the first age, one pound and twenty-nine ounces, part of which will be lost by carrying about the leaves, and the rest will be consumed by the worms in the intermediate time of the regular meals.

The windows ought to remain shut during the worms' first age, but the doors may be opened to keep up the required temperature, and to purify the atmosphere of the room.

Method of purifying the air.

The country people in Italy and in France use, for this end, a very simple means, by garnishing, from time to time, their windows with

* The Bavarian pound is divided in 32 *loths*, or ounces.

served in Germany, that age should last six days. But two meals only are then given in twenty-four hours, and this retards the growth of the worms, and their moulting, or the passage to the second age. During the moulting, fresh and healthy air is necessary, and contributes much to accelerate their growth.

§ 63.

3. *Rearing of the Worms in the second age.*

Before distributing the first meal, it should be ascertained whether all the worms are fully awake. They are then not very hungry, and they want free air, and a gentle heat, more than food. The moulting takes place, generally, in one day; whilst in the German method, two, three, and even four days are required, which, as has already been said, arises from the want of a proper regulation in the meals.

The difficulty in the casting often arises also from the efforts of the worms. For, as soon as they approach the moulting, and the first skin becomes too tight, from its not having extended in exact proportion with the growth of the body, the insect strives to throw it off: nature, besides, has already provided it with a new and finer envelope, and has endowed it with means of making the change. To this end, it eats much thirty or thirty-six hours before the body swells, and the strength of the insect is increased. Shortly before the casting, it ceases to eat, it cleans itself, and thereby becomes reduced in size. At the same time, it fastens the old skin with threads of its own spinning, to the twigs, to the hurdles, or the paper, moves about, and turns upwards with the head, until it issues or escapes from that skin. Often it remains in the meanwhile quiet, and seems in a state of torpor. During this whole process, which is a sort of crisis, it must not be disturbed: for it would otherwise be compelled to spin new threads, and to exhaust its strength in that operation.

First day.—This day, one pound and four ounces of branches are necessary, and as much fine chopped leaf, or two pounds eight ounces of the leaf alone. In the moment that all the worms are revived, and turn up their heads, the cleaning must begin, and the worms must be put on other paper. Those that are not yet awake, may be left where they are. The branches, and three or four leaves, serve the best for the removing, and, at the same time, for the first feeding. The enlivened worms will gather upon them, and may, in this way, be deposited on a new paper. The others are to be left undisturbed, until they have accomplished their casting. Feeble worms, which are unable to effect it, must be separated, and removed into another room, or cast away. One or two hours after, they are revived on a new bed; they are then covered with leaves; and on that day they need only two meals. The old papers are, in the meanwhile, cleaned out of the laboratory, and laid aside for future use.

Excremental matter of the worms.—The evacuation consists in a solid substance, under the form of little black globules, which should

be collected in a separate vessel. It is the best manure for hot-house and for flower beds, and furnishes, also, a green color. The boxes can be cleaned with a little broom; but it will be better to change them.

Second day.—Four meals are given, which require three pounds and three ounces of leaf. The first meals are less copious than the succeeding, and the space for the worms is gradually enlarged.

Third day.—The worms require three and three-quarter pounds of leaf; the first meals must be the most plentiful; for the appetite of the worms diminishes again towards evening, with the beginning of the second moulting. The space must also be enlarged.

Fourth day.—Two pounds and six ounces of leaf will be sufficient on that day; but the distribution should be regulated according to the exigencies of the worms. If the weather is not cold and windy, the windows may be opened; but the temperature must not be lowered more than one degree, and then the windows must be closed again. The sleep of the worms being promoted by a new and healthy air, they will all soon be in torpor.

Rating at three pounds six ounces, the expense of leaf for the intermediate meals, and some accidental loss, the whole consumption for the second age will amount to fifteen pounds.

§ 64.

4. *The Worms in their Third Age.*

First day.—Two pounds and twenty-eight ounces of food are required for this day, partly in small shoots, partly in finely chopped leaves. The more coarsely chopped leaf, can only be given at the close of the age. The surest sign that the worms are revived, is an undulating motion which they make with their heads, when horizontally blown upon. The shoots serve for the cleaning, as on the first day of the preceding age. Two more meals are distributed. The worms that have not accomplished the second age, must be placed separate in a warmer part of the laboratory, and they will then soon be equal to the others.

Second day.—This day ten and three-quarter pounds of leaves will be needed; and the first meals must be the least copious.

Third day.—Eleven and a quarter pounds of leaves should be given. The two first meals should be the most plentiful. Their change approaches.

Fourth day.—Six and a half pounds of chopped leaves will be sufficient. The first meal should be the largest. The worms that are not yet torpid, are fed alone, and often.

Fifth day.—Three and a quarter pounds of leaves must be kept in readiness, and distributed to the worms that are yet awake. This day the temperature of the laboratory should be kept unvaried; and therefore the windows must remain shut, whilst in the preceding day they might have been opened to improve the interior air.

Sixth day.—As the worms begin to awake on this day, little food will be necessary.

There are yet remaining 11 pounds 20 ounces of leaf, which may be employed in the way already explained; and the whole quantity consumed will amount to 46 pounds.

§ 65.

5. *Rearing of the Silkworm in the Fourth Age.*

First day.—On this day, four pounds and a half of the young shoots, and seven pounds four ounces of coarsely chopped leaves, will be needed. The space must be enlarged, and the cleaning should be well attended to.

Second day.—For this day will be required twenty pounds of leaves, coarsely cut. The two first meals should be the lightest, and the two last the most copious.

Third day.—For this day will be needed twenty-six pounds of leaves slightly cut. The last meal should be the most plentiful.

Fourth day.—This day thirty pounds of food will be needed; but the leaves are not to be chopped. The last meal must be of six pounds.

Fifth day.—Fifteen pounds of leaves will be wanted. The first meal should be the most considerable. A great number of the worms become torpid on this day.

Sixth day.—Three pounds and a half will be distributed, in a quantity proportioned to the wants of the worms that are awake.

Seventh day.—Most of the worms rouse on this day. In the period now elapsed, the windows and the doors should have been frequently opened to renew the air of the room, because the steamy vapor, which the worms discharge, begins to be perceptible.

The total amount of the food for the fourth age, being 139 pounds, it results, from the preceding statement, that 32 pounds and 28 ounces remain for intermediate distributions, &c. as explained above.

§ 66.

6. *Of the rearing of the Silkworms during the Fifth Age, until the completion of the cocoon.*

First day.—This day almost all the worms must be revived. The space where they are should be cleaned, and widened; ten pounds and a half of young shoots, and the same quantity of leaf, will be needed. The door and windows should be opened, and the interior air of the laboratory should be frequently renewed. One of the meals may consist of young shoots, and the two others of leaves.

Second day.—For this day will be wanted thirty-two pounds and three-fourths of leaves for the four meals: the first should be the least, and the last the most copious.

Third day.—This day forty-six pounds and a half will be needed. The first feed again is the less, and the last the most plentiful, and, as has already been said, the leaves must no longer be chopped.

Fourth day.—This day the worms will require 65 pounds 4 ounces of sorted leaves. The first feed should be of 13 pounds 28 ounces, and the last of 18¾ pounds.

Fifth day.—The worms will this day want 92¾ pounds. The first feed should be of 18¾ pounds, and the last of 23½ pounds. If necessary, the worms should have some intermediate food. The cleaning must take place towards evening, and the interior air must be frequently renewed, as on all such occasions. The doors and windows can even be left open, if the weather is not windy and rainy.

Sixth day.—The worms should have 111½ pounds of leaves. The first feed should be the most plentiful. If the quantity distributed has been devoured in an hour, an intermediate meal should be added. The beds of the worms should be widened.

Seventh day.—The worms will require this day 107½ pounds of leaves. The first feed should be the largest, and intermediate meals be given, as before. The worms approach now to maturity, as will be more largely explained in § 68. The refreshing of the interior atmosphere should not be omitted.

Eighth day.—The worms, this day, must have 75 pounds of leaves. The first meal should be the largest, and of 23 pounds, and the last should be the least plentiful. Some intermediate food should be given. During the last days of the rearing of the worms, they should be fed with the best sort of leaves, always culled from the oldest trees. The cleaning and the purifying of the air should be carefully attended to. These attentions are now more essential than on any former occasion.

Ninth day.—The worms, this day, need 60 pounds 14 ounces of leaves, which must be distributed as they may be wanted; the worms approach their maturity, and begin to eat with less voracity. The air must frequently be renewed, and the proper temperature should be preserved. The windows should, nevertheless, be opened, at intervals, that the interior atmosphere may be entirely changed.

Tenth day.—Twenty-eight pounds and four ounces of leaves will be sufficient, but more may be allowed, if necessary.

Eleventh day.—The worms are already engaged in weaving their cocoons. Those that show some appetite, and have not commenced their work, must, of course, receive a little food.

From the 795 pounds fixed for the fifth age, 154 pounds 18 ounces remain for accidental losses, and the intermediate meals.

It must yet be observed, that the maturity of the worms follows this daily progress only when the prescribed attentions, in regard to the feeding and the temperature, are strictly observed; otherwise, their growth is slower. Hence Mr. Nagel, who recommends two feeds only in twenty-four hours, fixes the first, second, third, and fourth ages at six days each, and the fifth at nine days, and he reckons for the moulting, two, three, and four days; whereby the life of the worms would last forty-three days, whilst, after Bonafous' method it lasts thir-

ty-two only.* The end is obtained in this latter method, as in the others, but with more slowness; and the silk rearer must make his calculations upon that difference.

The table at the end of the present volume will afford a summary and comprehensive view of the progressive rearing of the worms.

§ 67.

7. *A species of Silkworm of a dark gray color, with singular marks.*

I speak of this species only to refute the error that they are not real silkworms, or that they make a different sort of cocoons. But they need not be separated from the other species: for the cocoons will be exactly the same.

§ 68.

8. *The Cocoons.*

The maturity of the worms, and their capacity of forming the cocoon, are ascertained when they get upon the leaves without eating them, rear their necks as if in search of something; and, when looking at them horizontally, or taking them in the hand, against the light, their bodies seem transparent, which gives them the appearance of a yellow plum, or of white and ripened grapes. They give, spontaneously, signs of their maturity, by rearing their necks, by getting upon the edges of their beds, and by endeavoring to move along. The rings draw in, the skin becomes wrinkled about the neck, and the whole body has more softness to the touch than heretofore, and feels like soft dough. On the first appearance of these signs, and even in the last days of the fifth age, every thing should be prepared for their rising.

Preparations for the rising of the Silkworms.

The boxes in which the worms have been kept are put on the shelves which before have served for books or papers, and faggots, or bundles of dry, leafless bush, or brush wood, or common broom, are arranged, so as to end in an arch. The worms climb up, and generally seek to fix themselves on the top branches, where they begin to work their cocoons. Care must be taken to make them this easy, in order that they may not uselessly waste their strength and their silk; and they ought to be assisted in their climbing upon the faggots. Whilst the bundles are placed, the beds of the worms should again be cleaned, and the temperature should be kept at 17° (70° 3, Fahrenheit.) The branches of the faggots must, of course, be in sufficient quantity, and clean, and must not be laid upon the beds of the worms, but spread

* In Mr. Turk's Essay on the Culture of Silk, (Potsdam, 1825,) which has just come to my knowledge, thirty-six days are mentioned. Among the Bavarian cultivators, there are examples of forty, forty-four, and forty-seven days.

outside of them, like fans. Worms that are ready to rise, may be taken up and put near the ends of the faggots; but they generally find their own way, and prefer the higher stations for forming the cocoon. It is not necessary to be in a hurry to make them climb; but care should be taken that the space between the shelves be dry and capacious, so that the worms may work with ease. Experience shows, however, that some worms are so lazy that they remain immovable thirty-six hours after the others have begun to rise; to encourage them, a box with shavings of timber should be kept ready, with a few leaves, in which the weak worms are laid; and, by a temperature of 18°, (72° 5, Fahrenheit,) they will begin their work: the box may be covered with a sheet of paper, picked full of holes. This method has been employed with great success in the building of the Agricultural Society. At the beginning of the formation of the cocoons, care should be taken to feed the worms, which are yet hungry, upon the best leaves: the cocoons being formed, the beds should be taken away, to be cleaned in another room.

Completion of the Cocoon.

As soon as the worms are seen spinning their silk, the air may be permitted to circulate freely in the laboratory, but the temperature must not be lowered sensibly: the two extremes of heat and cold are alike injurious to the worms, and ought, therefore, to be carefully avoided. From the moment that the net begins to be visible, the worm works within the cocoon, and completes it in three days and a half; the worm is then transformed into the nymph. On the seventh or eighth day only, the cocoons can be taken from the faggots; this must be executed with much caution. The gathering must be commenced below, and continued upwards, and the soft cocoons must be separated from the hard ones. The flos silk ought also to be collected and kept separate, as it forms an article of trade. The cocoons diminish always in weight when they are long kept. They are sorted according to their colors: the white ones are the most precious; those of a yellow color vary in the depth of their shades, and some are of a greenish or yellow, like sulphur. In a well regulated culture, the weight of the cocoons is always in exact proportion to the space which the worms have occupied. 130 cocoons correspond to 239 feet square; and upon this fact the calculation may be extended.

Management of the Cocoons.

A selection must be made of the cocoons which are destined to serve as seed, and those which are to be sold, and employed in fabrication. If one or more ounces are to be applied for the culture, the seed cocoons of that weight must be chosen; sixty pair of butterflies are averaged for the ounce, and these give 120 cocoons. The best should, of course, be taken for the seed. They are distinguished by their straw color, by their greater hardness, chiefly at the extremities,

and by the superior fineness of their web. Double cocoons should always be excluded. The best are those that are a little depressed in the middle, as if tightened by a ring, and they are, besides, not the largest. If white silk is desired, the choice must be made among the white cocoons, exclusively. There are no certain signs to distinguish the cocoons which are to produce the male moth, from those that contain the female; but experience teaches that the cocoon which is smaller, sharper at one or both ends, and depressed in the middle, generally produces a male; and that a round, full cocoon, without much or any depression in the middle, contains the female. The cocoons intended for seed should be stripped of the flos, that the moth may not be embarrassed when it first appears; and the cocoons, thus assorted, should be laid separate. The killing of the chrysalis must be attended to, in regard to the remaining cocoons, to prevent them from being pierced by the moths, whereby the web would be injured, or so much disordered, at least, as to make the silk of the cocoon fit only for floret. The cocoons of the latter description form a separate branch of trade. Each silk-pod consists of one single thread, the length of which varies from 900 to 1,200 feet. This thread is reeled off, spun, and woven into stuffs; which process, however, more properly belongs to the manufacture than to the culture of silk.

The killing of the chrysalis is an important task, and must be accomplished with great care, in order that the silk-pods, or cocoons, may not be lost for the trade or manufacture. The three methods of doing this, are, 1st, The one most practised in Italy, and which consists in exposing, during three days, the grubs in the cocoons to the ardent heat of the sun, when the thermometer is at 25° (88° 2 Fahr.) from 10 o'clock, A. M. until 4 o'clock, P. M. 2dly, The one more generally followed in France, and by which the cocoons are thrown into a bag, and thus put into an oven where bread has just been baked, and the temperature is yet 25° (88° 2 Fahr.) The oven being shut, and the bags frequently stirred, the grubs are killed within four hours. And, 3dly, The process the most proper for Germany, viz: the killing by the steam proceeding from the scalding water with which a kettle is filled to the two-thirds. The grubs may also be killed by the vapor of sulphur; but this is the least certain method, and does not deserve a more particular mention. The killing must take place within the twelve days that follow the completion of the cocoon; because, on the 12th day, the grub begins to moisten the inner part of its silky habitation, to develop and to prepare itself for piercing it, and to fly, instead of creeping, as it had done before. The soft or weak cocoons must already have been sorted, and should be reeled immediately.

The double cocoons ought also to have been separated; because, to kill them, more time is required than for the single ones. Over a kettle, fixed in the wall, such as are used for washing linen, and filled with boiling water, two pieces of wood are laid across, upon which you put the clean basket with the cocoons, over which two or three woollen cloths are extended that the steam may penetrate completely.

The fire under the kettle must be kept up, so that the water may continue boiling. Three hours, in such heat, will kill the chrysalis. To ascertain whether this has taken place, one of the cocoons should be opened. The basket with the killed pods, is then left for a day, untouched, in order that the cocoons that have been softened, might harden again. But, on the next morning, the basket is to be emptied, and the cocoons are deposited in a place whence they may soon be transferred to a purchaser. The method employed with one portion of the cocoons, is to be continued until all the others are likewise killed. It seems that, in some parts of France, a paper steeped in turpentine oil is laid betwixt the cocoons, whereby they are killed within twelve hours.

§ 69.

9. *Two open Cocoons, or Cocoons with their grubs. The upper one contains only the shell of a developed chrysalis; but in the lower is seen the immature chrysalis, with the skin of the late moth.*

As this part of the plate does not need any particular description, we may here indulge in some general remarks upon the nature of the silkworm. Vested, upon its appearance, with a velvet-like skin, it falls, during its short life, into four torpors; and, after having thrown off its old skin, rises from each sleep under a new form, gradually becoming whiter, smoother, larger, and more beautiful, until at length it is perfectly transparent. Dissatisfied, as it were, with its abode upon the earth, it strives to climb towards Heaven, in search of a more perfect state of existence, and of a more complete metamorphosis than it has previously experienced, and prepares to sail through the airy space instead of crawling upon the earth. As soon as it has found a place where it can spin its silky bag, it pours two drops of a clear yellow liquor on the spot where it intends to fasten its web. The first web is the net of the above-mentioned flos silk, and destined, as it were, for external security. After having accomplished this task on the first day, it begins to spin, with a single thread, its habitation. It continues then to form the interior, and the closest to its own body, by means of a glutinous moisture, a compact felt-like vault, in which, after four or five days, it becomes a nymph, to repose, in that secure retreat, unhurt by wind or weather, and quietly awaits its approaching resurrection. The colored plate represents, distinctly, these different states. The chrysalis, as we have said, must be killed before it becomes a butterfly.

§ 70.

10. *A Cocoon from which the Butterfly is near emerging.*

The cocoons which are reserved for being pierced by the butterflies, require the following attentions:

The cocoons are laid upon separate hurdles, or upon a table, in boxes lined with linen or paper, like those in which the worms had been kept, or simply upon a sheet of paper, or a linen cloth. The room in which this is done must not be upon the first floor, and the temperature of the interior atmosphere must be from 15° to 18° (66° to 72° 5, Fahr.) If it be lower, the oven should be heated; and, if it be higher, the cocoons should be removed to a cooler room. If the air be moist, means should be taken to dry and purify it. From the day that the worm has spun its silk, an interval of twelve, sixteen, or twenty days follows, in proportion to the heat, before the butterfly emerges. The approach of this state may be known from the cocoon becoming somewhat moist, and from frequent signs of unsteadiness. The room must also remain light enough to distinguish the objects which it encloses. The butterfly generally makes its appearance in the first three hours after sunrise.

§ 71.

11. *A Cocoon from which the Butterfly has already escaped.*

The worm, metamorphosed into a butterfly, has now escaped from its prison, to enjoy a free life, and seems to have no other wish than to couple immediately, to propagate, and to die. The males may be distinguished from the females, by the fluttering of the wings, and by a comparative smallness. The flutter lasts until the male has found a female. Besides that the latter moves seldom, and stirs her wings very little, she is also bigger round the body. To prevent the coupling from taking place immediately upon the cocoons, as soon as the butterfly comes out, it should be taken by the wings, and laid upon the linen cloth, or the paper. If there are some already engaged in coupling, the pair should be seized, simultaneously, in the manner abovementioned.

It would still be better if the cocoons had been previously sorted, in regard to the difference of sexes, with a view of managing the coupling with more regularity: every thing can then be better observed; the moths that have coupled can be removed; those that are not yet prepared for it, can be left quiet in their places, to give them time to throw off a part of the liquor which they contain, mixed with earthy particles. If the males are too numerous, part of them should be put aside, to prevent them from disturbing the others.

§ 72.

12. *Two Butterflies in the act of coupling.*

When they are seen in this state, they must be put upon the frame represented in the cut fig. 8, page 75, or if there are none ready, they may be laid upon paper, or a linen cloth. The coupling is known by a certain tremor of the male which is upon the other moth. Shortly

afterwards, both must be gently seized by the wings; and when separated, they are put, according to their respective sexes, male by male, and female by female, or the male alone must be taken away. If there remain, yet, some butterflies after the coupling, they may be put in a band-box, pricked with holes, like the one represented in page 72, (fig. 7) until the proper moment of coupling has arrived. The room ought to be kept dark, and the interior air pure, and in the temperature above-mentioned. The male butterfly must remain paired from six to eight hours at least, and is then only removed. If there be not a sufficient quantity of them, the males ought only to be left with the females five hours; after which, the strongest are selected, to be laid, for a while, in the band-box, and are afterwards brought together, with another female moth, whereupon they proceed to a second coupling. Generally, the butterflies pierce at 6 or 7 o'clock, couple at 8 o'clock, and between two or four o'clock in the afternoon this act is accomplished. The male and female moths may then be separated. The former die a few days afterwards, without having taken any food in the interval, or done any thing beside the single or double propagation.

§ 73.

13. *The Female Moths laying eggs.**

Mr. Bonafous uses a sort of easel, covered with linen on both sides, whereupon another linen is extended for the eggs. The female moths are arranged one after another, from the top to the bottom of the canvass; but this is not indispensable. The moths may be laid at a proper distance from each other, upon a table covered with paper or a linen cloth, where the process can be distinctly observed. The moth lays the greatest number of eggs in the first 36 or 40 hours, and afterwards the 6th part only of that number. On an average, each lays from 400 to 510. The purity of the air, the temperature, and the obscurity, recommended above, must never be neglected. According to the temperature, the natural narcissus color of the egg grows darker, and becomes of a reddish gray. The eggs go within 15 or 20 days through these changes, and may then be considered as completed. A few days afterwards, when they have assumed an ash-gray color, the paper or cloth on which they are lying, is lifted up, folded four or eight times, and put in a cool dry place, where the temperature in the summer does not exceed 15° (65° Fahr.) and does not fall to zero in the winter. The best is to lay the packet upon a cloth, which is fastened at the ceiling of the room. During the hot season, it should be examined every fortnight, whether the eggs are not exposed to moisture, which would injure them. They must also be preserved from dust,

* The branch or leaf of the mulberry tree, represented in the plate, should not be overlooked. It is less indented than the others, and larger and rounder, because it proceeds from a grafted mulberry tree, or a tree that may be used for grafting, as has been explained in § 53. This species of leaf is very valuable.

mice, and rats. To convey them to a distance, they must be put, in the autumn, or early in the spring, in paper bags, or within reeds, the extremities of which should be covered with clean linen; and if they are to be sent very far, they should not be lifted from the linen cloth; but the whole packet is to be enveloped with muslin, over which you make another cover of paper, as if it were a letter.

This method was followed in the laboratory of the Agricultural Society. The eggs were left upon the paper, where the moths had laid them, and the papers were deposited, until the ensuing spring, in a small room, with a northerly aspect, and in which no fire had been made during the winter. As the eggs were to be sent away in the spring, sheets for an ounce or a drachm were used, which were cut in smaller portions, according to circumstances, and put under cover, to be thus forwarded by mail. The eggs reached their destination with safety, with the exception of a few, which, from the great distance, and the heat, were hatched shortly after having been received, and when the mulberry leaves had not yet shot. The Italians, if such an accident happens to them, put the worms in small bags, which they cover, on both extremities, with meal. The worms live in this manner several days without food, until the leaves appear; and this experiment has also been tried in Bavaria with success. The eggs are sometimes preserved in glasses, and sent in this way to a distance, covered with paper, pricked with holes. The eggs are scraped off from the paper, or linen, upon which they are lying, and which are put on a tray, and a little old wine is poured upon, which must be neither mulled nor sulphurated. Two hours afterwards, within which time the paper or linen should be stirred now and then, the eggs can be scraped off with a blunt knife, and washed with the wine, which is afterwards filtered into an earthen vessel. The eggs should be spread upon a perfectly smooth board, and laid in a cool place to dry, before they are put in the glasses. But the method more generally followed in Bavaria is the best. Some think that a change of place is as profitable for the seed of the silkworm, as for that of garden plants and grain. But the rearing will succeed more certainly with eggs obtained upon the spot.*

§ 74.

14. *Raw Silk, of a yellow or white color.*

Within six or eight weeks, all that belongs to the culture of silk has been accomplished; and in the plate before the reader, two sorts of silk are represented, one of a yellow, and the other of a white color; both of which have been reeled from one cocoon. On an average, from seven to ten pounds of cocoons give one pound of silk, which,

* We must here mention the experiment tried by Mr. Melallier, in 1818 and 1819, near Lyons, for a second crop. The eggs were hatched on the 26th of June, and the 15th of July: the worms were healthy and as large as the former. The cocoons were also equally fine. This experiment, we are informed, has since been renewed, frequently; and this may serve to encourage a hope of further trials and discoveries.

when carded, sells at 16 or 18 florins, and, when spun, from 20 to 24 florins. One pound of cocoons generally brings one or two florins, independent of the flos and the real floret-silk, which proceeds especially from the pierced cocoons. Nothing very accurate can be said in regard to the number of cocoons that may be averaged to the pound—the data collected, in this respect, varying considerably. Of the best cocoons, from 225 to 250, of the middling 300, and of the inferior, from 400 to 600,* and upwards, weigh a pound. This shows how much depends upon the nourishment and the rearing of the worms, which determine the quality of the cocoons, and consequently their value and weight. A pound of flos silk sells at 1 or 2 florins, and a pound of floret-silk at 4 or 6 florins.†

§ 75.

15. Here is represented the excremental substance of the silkworm;

* An article in Mr. Dingler's interesting Polytechnic Journal, (Vol. xx. No. 3, 1826,) deserves the more to be transcribed here, as this book, like the *General Advertiser for Germany*, has furnished, for some time past, several valuable remarks upon the culture of silk, and contributes to raise in Germany a new spirit in favor of this industry.

"*On the produce of the rearing of silkworms in Italy* —The "*Continuazione degli Atti dell' J. R. Academia Economico-agraria di Georgofila, Firenze,*" contains in the Art. No. 21 of the fourth volume, a letter from Mr. Lambruschini to Doctor Passerini, on the success which attended the culture of silk, after the method suggested by the celebrated Count Dandolo. Mr. Lambruschini, obtained a clear profit of 28 per cent. upon a capital of 1,500 lires, within six weeks, and in a year little favorable to the culture. Mr. Acerbi, the distinguished Editor of the *Bibliotheca Italiana,* far from believing that this result is exaggerated, mentions the fact, that one of his countrymen, near Milan, obtained, from two ounces of eggs, fifty pounds of cocoons, and, consequently, that, by an advance of 66 livres for mulberry leaves, he made a profit of 128 per cent. Within six weeks, rating the pound of cocoons at 3 lires only. He is convinced that no branch of industry is more productive than the culture of silk, if it be well understood, and pursued with intelligence.

"In regard to Germany, we must, before all, proceed to the plantations of mulberry trees. Twenty and more years will elapse before these trees will attain a sufficient growth for the pursuit of that industry, on a great scale. Those who are unwilling to lay out profitless, for twenty years, the capital required for the purchase of land, and the rearing and the management of the trees, must not expect to make 128 per cent. in six weeks. 'Sow before you can reap.' Private persons may feel reluctant to lay out a capital, the interest of which will be gathered by their children or grandchildren only. But, if a government be willing to enter upon similar enterprise, too many examples, and, namely, those of Maria Theresa, and the Emperor Joseph, in Austria, of Frederic II. in Prussia, and of the late Electors Maximilian and Charles Theodore, in Bavaria, will discourage them, by instances of a return of ingratitude for a generous solicitude, for much wisdom, and a paternal love, on the part of sovereigns. Such are the causes from which all endeavors to introduce the culture of silk in Germany have failed, until the present time; and they will only cease to exercise their mischievous influence, when the bulk of the nation will be more enlightened in regard to their economical interests, and enabled to discover the advantages they would derive from substituting for useless or noxious trees and bushes, the valuable mulberry, which thrives in every soil, and can even be planted as bushes."

† The mulberry trees bear a great price in Italy and France, and form an important branch of culture and industry. A considerable number of them, which are planted in the streets, and in places of public resort, are disrobed by the poor, and by children, without any expense.

in its first and last age. For details on this part of the subject, the reader is referred to what has been said above. (§ 63.)

§ 76.

Of the diseases of Silkworms.

The silkworm is a robust little animal, and its organization is simple; but the rearing of it is often so defective, that, notwithstanding its sound constitution, it frequently perishes from the ill management it experiences in its rearing. The several torpors which terminate the different periods of its existence, must not be reckoned among its natural diseases; they are, on the contrary, essential for its destiny, and the functions it is doomed to perform. They are an additional evidence of its admirable organization; and those worms which do not pass through these crises, are unfit for their principal destination—the spinning of silk. The diseases are—

1st. *The Gras, (La Grasserie.)*—A general swelling, which appears during the moultings. The worms affected with this disease, eat and grow, but they cease to spin, and are whiter and more clammy than the others.

2d. *Consumption.*—The worms affected by this disease, have an exhausted appearance, and they grow slower than the others. They do not feed, grow soft to the touch, and are frequently suffocated by the other worms. In the hands of unskilful rearers, this disease makes rapid ravages, chiefly after the third moulting has commenced.

3d. *Jaundice.*—This disease differs from the *Gras* only with respect to the time at which it makes its appearance. It begins after the fourth age, when the worms are near spinning their silk, and it is greatly ascribed to the infiltration of the nutritious moisture, and of the silky matter. Instead of attaining their maturity, they swell, and gold colored spots become visible upon their bodies.

4. The *Numbness.* (Muscardine.)—The worms grow stiff, and die in any age that they are attacked by this disorder, even after they have begun their cocoons. Their color, which at the beginning is scarlet, becomes white. The disorder is discernible after the death of the worm, by the hardness of the body, and a sort of mould with which it is covered. It was long doubted whether this disorder was contagious; but experience has shown that healthy worms, brought together with some that were attacked by the *muscardine*, were infected by them. It is, therefore, indispensably necessary to clean well the room, the vessels, and all the instruments, whenever the disease has any where made its appearance, and to separate carefully the healthy worms from the sick.

Besides these principal disorders, there are yet many others which kill the worms, when they are not well tended. At the approach of the time of the formation of the cocoons, some worms seem transparent, which proves that they are filled with water. They do not spin their silk, and die soon. The French distinguish them by the name of *vers clairs.* Other worms seem to search in vain for a place where

to spin their silk, or, as if they were affected by the weather, they exhaust their strength, and the silky matter thickens in their bodies, so that they soon die, without having made their silky bag. In French, they are called *vers courts*. Upon discovering any worms in this state, they ought to be carried away, or deposited in another room, where they might, perhaps, still spin their silk, though of a coarse kind.

There may be sometimes worms which, being dead, preserve a fresh and healthy appearance, except that they are very soft to the touch. Their disorder is called *tripe sickness*, and the worms attacked with it bear in French, the name of *morts blancs*. Those who pursue the culture of silk, upon a great scale, do not trouble themselves much with the many lazy, weak, exhausted, and sick worms, but cast them away: but some persons sort them, and endeavor to make some use of them, especially of the lazy worms, as has already been said in § 68. It is evident that all the disorders originate from a suppressed perspiration, an excessive, or insufficient, or unwholesome food; such as dusty, moist, and mildewed leaves, from uncleanliness, and from a want of attention to the temperature of the place where they are kept. If every necessary care is taken, no disease will appear; and, by the way, the same will happen with every organized animal.

The worms that have been fed too copiously, can be cured before the swelling (*la grasserie*) has made considerable progress, by separating them from the others, and by subjecting them to a regular diet. The want of food, which commonly happens during and after the fourth age, from the great quantity which the worms then eat, and from a miscalculation of the quantity of leaves, of which there is a provision, can only be remedied by casting away a portion of the insects. The best thing that can be done in the jaundice,* and in the other diseases, is to separate the sick worms from the healthy, to save, at least, the latter, and to prevent contagion. Experience warrants the further remark, that, in the culture which was pursued, during four years, in the building of the Agricultural Society, no disease has been observed among the worms; and that not twenty from among many thousands have perished, although no other care was taken than to keep the laboratory very clean.

§ 77.

Of the Diseases occasioned by the Culture of Silk.

It must not be concealed, that some antagonists of this industry have maintained that it is injurious to the human constitution. But this is a mere prejudice, or a vain pretence. No human being has yet suffered bodily from this cause. The French and the Italians would laugh at any one who should endeavor to alarm them with such fears; and there are in Prussia, as Mr. de Turk observes, many families, who have been pursuing the culture of silk for a number of years,

*Count Dandolo has offered a prize of 150 Louis d'or for the discovery of an infallible remedy against the jaundice: but it is yet to be won.

and have, nevertheless, reached the greatest age that man can attain. Many similar instances may be found in Bavaria.

§ 78.

Of the Enemies of the Silkworms and the Cocoons.

The enemies of the silkworms are sparrows, swallows, robins, the titmouse, and other birds of this kind; care must, therefore, be taken to keep the windows closed against them. Fowls are also in wait for them, and not less mice, rats, weazles, lizards, ants, and spiders. These latter make, perhaps, the most active war against them. They place themselves upon their necks, and sting them to death, as if it were from envy that the silkworms excel them in the art of weaving. Spider-webs ought, therefore, to be carefully cleared away, and all possible precautions should be taken against the other enemies which beset these poor insects. Thunder and lightning have been added, but wrongly, to this long list of perils.

If the cocoons are kept too long, especially in a close room, they are exposed to a particular species of moths, which pierce them on all sides; and, in consequence of which they are, at best, useful for floret silk only, and are not unfrequently entirely destroyed.

§ 79.

Of some particular species of Silkworms, and that with white Cocoons.

To complete our exposition of the culture of silk, we must yet mention that species of silkworms, known in France, which have but three moultings, and spin their silk at the end of the third age. Their eggs weigh one-eleventh less than those of the common silkworms, and their cocoons are two-fifths smaller. They need daily, nevertheless, as much food as the others. In the first and second age they eat as many leaves as the ordinary worms in the same period of their lives; but they want much more in the third, when they are extremely voracious, especially upon the midribs of the leaves. The cleaning must be attended to on the fifth day of the third age, as, with these worms, this age is longer than with the others. Their cocoons furnish a finer and more beautiful silk; they are more finished, and the manufacturer derives from them, proportionally, a greater quantity of silk. These cocoons are, nevertheless, less sought after than those of four moultings. Their rearing is but by four days shorter; from which circumstance the mulberry trees are sooner stripped of their leaves; thus, time and money are equally expended; but, as these worms have a shorter life, the risk of losing them is less. Combining these circumstances, Count Dandolo recommends particularly this species of culture of silk. There is, besides, a species of silkworm which invariably furnishes white cocoons.*

* The Agricultural Society has a supply of them, and is willing to distribute them.

With respect to time and to management, their rearing is the same as that of the other species. Their increase would be advantageous to the silk manufacturer, on account of the natural white color of the silk; which, therefore, can be employed without any preparation, in the fabrication of such stuffs which require the pure white color, which it is impossible to imitate. But the produce of the common yellow cocoon is said to be greater.

Intelligence received from Italy within the last year, gives the following view of these three species of worms, as they are found in that country. "Two principal species of worms are reared in Piedmont. "The cocoons of the one are yellow, and belong to the most common "species. Those of the other are white, and the species which furnish-"es them, is principally reared in the neighborhood of Novi. There "is a third variety in France, in the environs of Alais, which the "government procured from China fifty years since, and which pro-"duces a very white silk. Mr. Bonafous, of Turin, has instituted "comparative experiments with a specimen of the latter species, which "he obtained from a pure breed belonging to a cultivator of Alais, and "the white one of Piedmont, with an equal quantity of eggs; and the "result he obtained, warranted the conclusion that the greater white-"ness of the Chinese silk is too small a superiority to be considered "as a compensation for the less quantity which is obtained from a "rearing perfectly equal, under all circumstances, of both species of "worms."

But all such calculations depend on the wants and means of the silk manufacturers.

§ 80.

III. *Of the means within the power of government for promoting the culture of Silk.*

According to the maxim laid down in section 28, *No Board connected with the Government, no particular administration, no public officers, no expenses. The culture of silk shall be an affair wholly belonging to the people, an incidental business, the secondary task of servants, children, paupers, and old people. Encouraged by the example of Greece, Italy, and France, we wish to trust it to the fair hands of ladies, who could, by way of amusement, and without any expense, obtain, within six weeks, a more elegant material for the ornament of their persons and apartments.* The intervention of a government can only consist in encouragement and protection. The management of the culture, and of all the collateral branches, will prosper better in the hands of a society, acting at the impulse of a fond predilection for the pursuit, and of patriotism, and accordingly is sure to succeed more completely and more promptly. Such motives occasioned the formation of the Board of Silk Culture in Bavaria, and explain the success which it has already obtained. Composed of persons well acquainted with the subject, each of them renders the services for which he is the most adequate, and all strive for the same end, from the purest interest for the welfare of the community.

§ 81.

The encouragement which a government can, and should afford, would be evident—

1st. By procuring from abroad a large number of good mulberry trees, and seeds of the mulberry, and of eggs.

2d. By the plantation of the trees on public squares, and other places of public resort.

3d. By the directing the foresters and gardeners in the service of government, to attend to these new plantations.

4th. By facilitating the means of extending the knowledge of this branch of rural economy.

5th. By stimulating schoolmasters and country clergymen to take interest in the same.

6th. By offering prizes for the most industrious cultivators of silk.

7th. And other such premiums for the greatest number of cocoons.

The protection may be evinced—

a. By protecting the mulberry trees from damages.

b. By encouraging silk cultivators to settle in the country.

c. By securing the consumption of the national produce in the country; and,

d. By offering bounties for the exportation of the same.

§ 82.

1. If a society, like the Silk Company of Great Britain, have sufficient means for purchasing mulberry trees, &c. &c. they need no pecuniary assistance from the government. The Agricultural Society, and afterwards the Board of Silk Culture in Bavaria, entered upon the undertaking, as has already been said, with their proper resources, and might not have wanted any advance from the government—for the Board distributed, in the course of two years, a great quantity of trees, seedlings, and still more of mulberry seed, without any remuneration; but it was to be foreseen that, in this way, the end would be obtained but very slowly, and that the zeal for the new culture might meantime decline again. The Board accordingly solicited from the States General of the Kingdom, in 1825, a pecuniary assistance, and the House of Representatives evinced a warm interest for the subject, and defended it.* I repeat, if there were no pressure of time, no money would be necessary to purchase the trees indispensable for the culture. A few florins are sufficient to procure seed from Italy and France, and such an expense will never fall heavy on any company. With the seed, there would be hedges within five or six years; and, within twelve or fifteen years, there would be standard trees, from which a sufficient quantity of leaves could be gathered. The same

* The reader is referred to the Journals of the States General, and to the reports laid before the House of Representatives; especially the one written by Baron de Closen, (1825,) in which mention is made of my own detailed *Exposition of the progress and actual state of the culture of silk, and its wants.*

result might be obtained within two years, in purchasing, for instance, in Italy, trees or seedlings, which, in that country, cost but little, and the transport alone is expensive. To gain time, such a purchase might be advisable for every country; and we may mention, as an example well worthy of imitation, a rescript of His Majesty, our reigning monarch, published shortly after his ascension to the throne, and by which he has become the greatest protector of the culture of silk in Germany. It was addressed to the General Committee of the Agricultural Society, and is as follows:

"By the rescript of the 11th of December, 1825, His Majesty has been pleased to grant to the General Committee of the Agricultural Society, for the two years of 1825 and '26, and 1826 and '27, as a first means of encouraging the culture of silk, the sum of six thousand florins, which the said Committee of the Agricultural Society was directed, in concurrence with, and chiefly upon the suggestions of, the Board of Silk Culture, connected with the aforesaid Society, to employ in the distribution of mulberry seed and eggs, *gratis*, to such persons, or public authorities, as should make application to that end; and in procuring mulberry trees and seedlings, in preparing prizes for cocoons, in providing for such instruments and regulations, as would be the most necessary, and in extending the art of reeling silk, &c.

"Whereupon, the Board caused, on the 2d of May, 1826, the following advertisement to be published:

"*Recent progress of the Silk Culture in Bavaria.*

"Through the generous assistance of His Majesty, of which the public has already been informed, the Board of Silk Culture was enabled to procure from Italy a considerable number of mulberry trees. Six wagons of them arrived here on the 3d of April, with 5,740 standard trees; 23,000 three year old seedlings; several hundred cions; and twelve first-rate mulberry trees: thirteen pounds of mulberry seed, (fifteen pounds of our weight,) and sixteen ounces of silkworms' eggs.

"The whole arrived in perfect state of preservation, and the prices and the other expenses have been moderate.

"The Deputation has immediately proceeded to the distribution of these means of pursuing the culture, proportionally to the demands that had been made by the public authorities, or by private individuals, in the Circles mentioned in the following statement, which, at the same time, shows the quantity and the nature of the things distributed:

CIRCLES.	Standard Trees.	Seedlings.	Mulberry seeds.	Silkworms' Eggs.	
			lbs. oz.	*Ounces.*	*No. of Eggs.*
Isar, - -	2,124	6,534	4 15¼	8	13,500
Lower Danube,	506	1,910	22½		
Regen, - -	446	1,292	29¼	5	12,600
Upper Danube,	529	1,437	8½	1	17,400
Rezat, - -	628	2,246	25½	4	13,000
Upper Main, -	519	900	28		
Lower Main, -	646	1,310	12¾	-	5,000
Rhine, - -	348	802	8		
	5,746	16,431	14 21¾	21	61,500

"There are, however, in the nurseries of Nymphenburg, Schleissheim, in the garden of the Agricultural Society, and in several parts of the kingdom, many thousands more of these trees, partly procured from Italy, and partly raised from seedlings. Adding to all these the hundreds of trees and seedlings that have been distributed, within the two last years, by the Board, from their own means, the several pounds of mulberry seed, and the fifteen pounds distributed recently, each ounce of which may be estimated at ten thousand seeds, it will be seen that, in the present summer, there are many thousands of trees and millions of seedlings in the kingdom. Considering, also, that within four years, many ounces of eggs, and that in the present year twenty-one ounces have been distributed—that each ounce yields twenty thousand worms, and that several cultivators, principally in the circles of the Upper and Lower Main, have purchased such seed—it may safely be assumed, that there will be in the ensuing month of June, at least half a million of silkworms in Bavaria. It was gratifying to observe, that not only many hundred individuals from the several circles in which the kingdom is divided, solicited mulberry trees, &c. but that all the public authorities made similar applications for the Wood and Forests and Salt Administration, as well as many public institutions, tribunals, magistrates, the Royal Court, Marshalship of Wurzburg, the Royal Garden Intendancy, clergymen, school inspectors, and schoolmasters. There is little doubt that the trees will be managed according to the directions given in the published instructions, as hereafter new distributions will be made to those only who shall be able to prove that they have followed them carefully; and, finally, it may be expected, that, according to the benevolent intentions of His Majesty, the country will possess, within a few years, in the culture of silk, an important branch of industry and of public wealth."

§ 83.

2. The government can encourage the respective authorities and communities to plant mulberry trees in all places of public resort, in church yards, in the gardens of hospitals, schools, and other national institutions—such as the theological seminaries, these trees being not only a fine ornament, but highly calculated to enlarge the resources of the country.

§ 84.

3. The king and his personal servants, by condescending to give the laudable example to introduce these trees into the Royal Gardens and Plantations, the whole country would feel encouraged to imitate it. The distribution of trees might then be easily enlarged. By such means as we had already mentioned, the culture of silk prospered in France, under Henry IV.* An equally great model will be our most gracious sovereign. More has been even done already in our country: for all the Royal Wood and Forests authorities have been directed to attend to the planting of mulberry trees; and thus that branch of the public administration has been awakened to its true destinies, viz. to furnish and to provide for the multiplication of the finer species of trees, which may contribute to extend the industry and enlarge the resources of the country; skilful and intelligent gardeners, instead of providers of fuel only. The two royal regulations upon this subject are as follows:

"*To the General Committee of the Agricultural Society of Bavaria.*

"His Majesty having directed me, by his royal order of the 28th of February last, to make an extensive plantation of mulberry trees in His Majesty's gardens, by means of which a considerable quantity of trees, well grown and well reared, and accustomed from the beginning to the soil and climate of Bavaria, might be distributed every year, I respectfully beg the General Committee of the Agricultural Society to incline the Board for the Culture of Silk to deliver, before the ensuing spring, the greatest number of trees they can dispose of, in order that I may be enabled to obey the commands of His Majesty.

"I have the honor to be, &c. &c.

"SKELL,

"*Inspector of the Royal Gardens.*

"MUNICH, *March* 4, 1826."

"*Plantation of Mulberry trees in the Royal Forests.*

"Circular letter of the Treasury Department to all the Regencies of His Majesty.

"The king has been pleased to grant to the respective circles considerable pecuniary donations, for the promotion of the culture of silk

* Through Olivier de Serres's active exertions, a short time was sufficient to enrich the gardens of the Tuilleries, in Paris, with twenty thousand mulberry trees, and to lay the ground in France for the culture of silk.

in the kingdom, and to manifest a wish that all possible attention and support may be given to this branch of industry. The officers of the Administration of Woods and Forests would seem to be the best situated to contribute to the progress of this industry, were they directed to rear, on proper spots, mulberry trees from the seed, to enable, afterwards, those who devote themselves to the culture of silk to transplant them.

"The Chamber of Finances will, therefore, not neglect to fulfil His Majesty's intentions, in directing and enabling wardens and other officers of the forests, the most apt to further this end, to contribute to it with all their means. There is surely no want of places in the royal forests; and it will not be difficult to prepare the soil for the seed, nor to shelter the spot selected for the plantation. The real and only difficulty consists, therefore, in procuring the mulberry seed; and, in order to remove this difficulty, nothing more is requisite than to co-operate with the General Committee of the Agricultural Society.

"As undoubtedly the Regency will be willing to adopt all the regulations which this important subject may require, it is expected that detailed accounts will, in due time, be received, of the measures that have been taken, and of their results.

"MUNICH, *January* 8, 1826."

§ 85.

4. It is the more necessary to extend the circulation of the printed instruction concerning the best method of planting and raising mulberry trees, and of managing the silkworms, as an imperfect knowledge of this culture was the main cause of its decay. For the cultivator who pursues it on a small scale, a few pages will be sufficient. But those who mean to carry it to a great extent—public officers, clergymen, schoolmasters, and especially the fair sex, will need more ample directions, as they not only should be more instructed for their proper advantage, but to be the abler to advise and guide others. The Society which is engaged in the direction of the culture of silk, must therefore provide for an extensive circulation of such printed instructions, according to the example given by the Board of Silk Culture in Bavaria, who have abundantly distributed such instructions gratis. A government can easily do all this, and without much expense, and ought to do it, on the ground that this industry cannot be considered as established in a permanent and profitable manner, unless an adequate knowledge of its management be generally extended.*

* I have just read a report inserted in the Transactions of the Economical Society of Moscow, which had been addressed to them by Mr. Castelle, on the 27th of February, 1826, and from which it appears that although the culture of silk had been neglected in all the other provinces of the Russian empire, it has nevertheless made such progress in the Caucasus, that the Russian manufacturers are enabled to use native silk. For this, the Russians are indebted to the wives of some soldiers, who were instructed in this art; and the merit of this improvement is ascribed to the Generals Jermolow and Welzaminow.

§ 86.

5. Much will be gained, in this respect, from the day that clergymen and schoolmasters will take an interest, and become public teachers in the art of cultivating silk, after having acquired the knowledge necessary for the pursuit, in seminaries provided with mulberry trees. They should induce the fair sex to pursue this industry, after the example of the Chinese, Greeks, Italians, and French. Among these two latter nations, the culture of silk is chiefly committed to the charge of female servants, in whose indentures this task is generally expressly mentioned, and this is done by leaving to them the foliage of a few mulberry trees; by giving them a certain quantity of silkworms' eggs, and by permitting them to sell the cocoons for their own profit.

§ 87.

6. Ambition and honor are two powerful impulses of human actions. Both should be called into action for the end we speak of. The government ought to offer yearly premiums for improvements in agriculture and industry. The most active cultivators of silk ought to have the chance of obtaining the prizes. There exists already, in Bavaria, such a system, and the agricultural festivity of October is not lost for the silkweaver. The greater the prizes, the greater the emulation will be.

§ 88.

From the beginning of the culture in France, premiums were distributed to those who pursued it, and namely, 30 sols per pound, in preserving the right of disposing of the produce. Similar encouragements were granted in Austria and Prussia. It is natural that those who were at so much trouble to procure the cocoons, should wish to know how to dispose of them. If there be, independent of a certainty of selling them, a reward for their production, the industry cannot fail to prosper rapidly.

Premiums were formerly also distributed in Bavaria, but it seems that in this kingdom, as well as in Prussia and Austria, some abuse took place in the distribution; as in each of these countries complaints became general in regard to the diminution of the cocoons, and the impossibility of making any profit by them. Several pounds of them, eaten indeed almost wholly by worms, that had been collected in the long interval from 1780 until the present year, have been sent to the Board of Silk Culture, in Bavaria, as soon as it was known that the Board was willing to pay a florin for the pound; and the persons who sent them, observed, that formerly the Electoral Silk Directory made difficulties to purchase them. As has just been said, the Board thought that, independent of the price, a premium ought to be paid; and, accordingly, they informed the public, by an advertisement dated September 6th, 1825, *that they would pay one florin for the pound of killed and sound cocoon; provided it be accompanied by a certifi-*

cate of a competent authority, stating that it had been obtained by the person who sends it, from the culture pursued by himself, and from mulberry trees planted within the kingdom. The Board caused the cocoons that were sent them, from 1823 to 1825, to be fabricated, at their expense, into ribbons, handkerchiefs, and other stuffs, and proportionally distributed these manufactured articles to the persons who had forwarded the cocoons. Of course, those who prefer to keep them, with a view of selling or manufacturing them themselves, are perfectly free to do so.

The measure adopted by the Board has no other purpose than to ensure to the cultivator a market for his produce: money in return for his labor; because this is the best method of encouraging any industry. It is clear that the Board cannot sell them at the purchasing price, principally when there are no silk manufacturers. They make, therefore, in the beginning, some sacrifices by the difference of the price they pay, and the money they receive. This includes, however, the premium; and it is obvious, on the other hand, that when once there shall be a sufficient sale for cocoons, silk manufacturers will soon form establishments; competition will arise, and the price of the cocoons will increase. Within a few years, the Board will no longer be obliged to purchase them, but may leave them for the search of private individuals; because the sale will be certain, when once the fabrication shall have made some progress.

§ 89.

We come now to the *protection* which government is able to afford to the culture of silk, and it is of great importance; because the most auspicious beginning would remain without ultimate result, if such assistance were wanting.

a. In many parts of Germany, young fruit trees and the like, planted on open places, are not secure from the attacks of wanton rudeness or malignity, and not a few are cut down, during the night. Severe enactments tended, at an early epoch, to obviate this evil; and new regulations have been published to the same effect. It is but thirty years that the traveller's eye was struck by boards fastened to trees, representing a hand cut by an axe, or nailed to a wheelbarrow, as a monitory intimation of the punishment which awaited every person that should damage trees; but there was in this more show than reality. To this day, to this hour, no young plant is secure. We could mention a considerable town in Bavaria, where, but a few weeks ago, some remnants of the former mulberry plantations were cut down, in a single night, from no other motive than because a distinguished schoolmaster used them for an attempt to cultivate silk. The new plantations may have the same fate, if some preventive measures were were not taken: for the greatest part of the alleys which adorned the public roads of the kingdom twenty years back, had no better luck. This occasioned, then, an ordinance that may be found among the acts of 1805. It enumerates the several species of offences: "for

"which injuries, committed on either fields, meadows, gardens, single "trees, or forests, the villagers in whose precincts such an offence has "been committed, or, in case of damages caused by game, the owner "of the same will be answerable for the reparation. But, if the cri- "minal be arrested, he shall be obliged, independent of a public pun- "ishment, to pay threefold the value of the damage he has committed; "one part of which will be for the plaintiff, and the other two for the "treasury of the community, as a compensation for the disburse- "ments they will be compelled to make, when the criminal is not "known; and if, in case of being arrested, he is not able to pay three- "fold the value of the damage committed by him, he shall pay it "by his labor, at the rate of the daily wages of a hired workman, and "the third part of the same will be allowed for his personal main- "tenance. If the amount of the damage be contested, the plaintiff "shall be permitted to state it under oath; the judicial authority being, "however, entitled to interpose its own decision, and leaving to the "parties the recourse of appealing to the higher tribunal, after four- "teen days."

This regulation saved many meadows, and strengthened the zeal for the plantation of fruit trees, at a time when there was, in reality, no need to encourage agriculture in Bavaria. It is obvious that such measures are now indispensable. If, for each damage, a long litigation must be instituted against an unknown offender, the injured individual is deterred from claiming his right, or his taste for agriculture is checked. A community has more means of detecting the offender; as, generally, he is one among them, and each of its members is interested to discover him, and give him up. Experience has confirmed the fitness of these regulations, and their strict maintenance is probably the only means of protecting the projected mulberry plantations.

§ 90.

b. To relieve the Society for the Promotion of the Culture of Silk from purchasing all the cocoons that might be brought to them, and to give rise to a greater competition, it will be necessary that more silk manufacturers, weavers, &c. &c. should form settlements. They will be the more indispensable, as it is desirable that the fabrication of silk should go apace with the production of the material—the former being ever more profitable than the latter. Government should, therefore, take care to attract skilful manufacturers, to render their settlement in the country easy, and to encourage and to protect them. When the raw material shall exist, there will be no difficulty to gather together persons able to turn them into stuffs and the like, if no obstacle is expressly or unintentionally created against their coming and their settling in the country.

§ 91.

c. In order to combine the fabrication with the production of silk, it may be necessary, *in the beginning*, to provide means for securing

a national market to the cocoons, and the silk derived from them; because, otherwise, an infant culture and fabrication would easily be crushed by foreign competition, as young plants are suffocated by lofty trees that overshadow them.

§ 92.

d. To promote the internal production and fabrication of any article, other States, as, for instance, England and France, have granted from the public treasuries, bounties on the exportation of such articles, and this liberality has produced a very good effect. This system might be successfully applied to silk products, and might serve to invigorate the culture as well as the fabrication of that material. But the bounty for exportation can only come into use when the production has already made a great progress, and when no premiums are longer necessary for the cocoons, which would find an easy sale without such an assistance; and the money which, accordingly, is saved upon that head, may, therefore, be applied to the payment of export bounties, which may not unaptly be compared to the seed whereby a country thrives at once in its means of production and fabrication, and consequently in its population and wealth—which are the richest crops that political culture can aim at.

§ 93.

IV. *Of the manner in which a "Society for the promotion of Silk Culture" should proceed in the sphere of its activity.*

The sphere of its activity is sufficiently indicated by what has been said in § 28, and is exemplified by the fundamental principles which have been laid down for the organization of the Board of Silk Culture in Bavaria. Should, however, any one again ask, "but what does the Board do for the culture?" The answer would be easy and simple. At present the Board attends to the following objects:

1st. To the planting of mulberry trees.

2dly. To the procuring of silkworms' eggs; and

3dly. To the advising in the management of the same, &c.

When these three ends are obtained, then, and then only, begins the fabrication; and for this latter result, some preliminary measures have also been taken.*

* Mr. Wurz, who attends not only to the culture of silk, but also to the reeling and spinning, has been provided by the Board, with a reel of a modern construction, imported from Italy, and with a portable filature. The king has, besides, granted him 3,039 florins for the purchase of a warming cylinder, to enable him to give to the silk a brilliancy not inferior to that of the French His looms are, besides, constructed upon the best and most modern French models; and they ought always to be altered according to the improvements which are successively made in these engines. When there will be a greater market for the cocoons, a portable filature will, of course, be insufficient. A larger one will become necessary, like the one which formerly existed in the Royal Garden; and the improvements since made in Italy, should be imitated. When the proper time shall have come, individual exertion will not need any encouragement for such expenses and such enterprises.

1st. The Society should make experiments, upon their own plantations, with all sorts of mulberry trees, with the graft, &c. &c. &c. and publish the most remarkable results of the culture, and answer to the queries that might be addressed to them respecting the means of promoting it. The Society should endeavor to extend the plantations of mulberry trees. They are, as it were, the central school, where advice and instruction may be sought after, from every where; and they should be equally attentive to keep up standard trees, as to have a provision of young plants, in order to be ever ready to supply each demand; and, finally, they should take care to preserve the best mulberry seed.

2d. The Society should be careful in the choice of the silkworm's eggs, to the end that they may be able to satisfy, in this respect, also, every demand: and this is not all. They should pursue, upon a small scale, at least, the culture of silk, and institute experiments to improve it more and more, and to be able, if possible, to publish some new interesting facts.

3d. The Society must always be ready to teach and to advise, respecting, as well the management of the mulberry trees, as the rearing of the silkworms. They ought to endeavor to discover the prevailing errors and defects, and to remedy them. To that end, they should be on the lookout for every new publication on mulberry trees, and the cultivation and fabrication of silk; to be always at the height of the progress made in these several respects; and to adopt, accordingly, the most appropriate measures.

The Society will further be the channel of communication between the cultivators of silk and the government, to be the more able to encourage every where the culture, to carry, wherever it is useful, information concerning its actual state, and to increase its advantages, as well in regard to the private interest of the cultivators, as to the interest of the community at large—the body politic. It behooves, of course, the Society to be the medium through which the *distribution* of the prizes and premiums are distributed, and of the sale of the cocoons, and of all that may be done for the advancement of the culture. Similar services may be expected from the Society, as has already been said respecting the fabrication, when the abundance of the cocoons shall give rise to it. The Board of Silk Culture of Munich, may flatter themselves to have sedulously attended to these several objects; and the happy results which are obvious to the examiner of the actual state of the culture in Bavaria, will be still more evident with the progress of time, if the same activity continues to be displayed.

§ 94.

Conclusion.

When all that we have mentioned in the preceding § shall be accomplished, who will still question, whether the German nations can aim at seeing this important branch of culture and industry flourish

among them, to the same degree as it has prospered in Italy and France? Who will deny, that, if such a happy result should be obtained, many millions will be saved to these nations? And, finally, Who will still contend, that this new branch of industry is not proper to increase population, welfare, and public wealth?

)ce,s in Silkworms, from
fomi

eeare gradual
I he most co
ece meals mu
rogradually s
tir If more days, in consequence of the loss

s t be, at th be renewed. Two more feeds.
Thace is to b

UNIV. OF MICH.